EVALUATION OF OUTCOME FOLLOWING MINI GASTRIC BYPASS SURGERY FOR MORBID OBESITY

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Dedicated

to

my family

&

Teachers

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ABBREVIATIONS

& –	And
BMI –	Body Mass Index
BP –	Blood Pressure
CI –	Confidence Interval
DBP –	Diastolic Blood Pressure
DMC&H –	Dayanand Medical College and Hospital
DVT –	Deep Vein Thrombosis
ECG –	Electrocardiography
EWL –	Excess Weight Loss
FBS –	Fasting Blood Glucose
GEJ –	Gastro-oesophageal Junction
GERD –	Gastro-oesophageal Reflux Disease
Hb –	Haemoglobin
HbA1c –	Glycosylated Haemoglobin
HDL –	High Density Lipoproteins
HTN –	Hypertension
LAGB –	Laparoscopic Adjustable Gastric Banding
LCD –	Low Calorie Diet
LDL –	Low Density Lipoproteins
LMGB –	Laparoscopic Mini Gastric Bypass
LOAGB –	Laparoscopic One Anastomosis Gastric Bypass
LRYGB –	Laparoscopic Roux-En-Y Gastric Bypass

LSG –	Laparoscopic Sleeve Gastrectomy
MCV –	Mean Corpuscular Volume
NSAIDs –	Non Steroidal Anti-Inflammatory Drugs
OAGB –	One Anastomosis Gastric Bypass
OD –	Odds Ratio
OSA –	Obstructive Sleep Apnoea
PPIs –	Proton Pump Inhibitors
SBP –	Systolic Blood Pressure
T2DM –	Type 2 Diabetes Mellitus
TC –	Total Cholesterol
TG –	Triglycerides
UGIE –	Upper Gastro-intestinal Endoscopy
VLDL –	Very Low Density Lipoproteins
WBC –	White Blood Cell
WHO –	World Health Organisation

ABSTRACT

Introduction- Rutledge's Laparoscopic Mini-Gastric Bypass (LMGB), was proposed as a simple and effective treatment of morbid obesity. However, controversies about the relative efficacy of this procedure remain, concerning its effect on weight loss, lipid profile, comorbid conditions like type 2 diabetes mellitus and hypertension, and development of post-operative complications.

Aims and objectives- The aims and objectives of this study were the following:

- To look for changes in the Weight/BMI of the patients.
- To look for changes in the Diabetic and Hypertensive status of patients.
- To look for changes in the Lipid Profile of the patients.
- To look for post-operative complications in the patients.

Materials and Methods- This was a retrospective and prospective study conducted in DMC&H, Ludhiana, on 50 patients admitted from 2015 till 2018, 35 females and 15 males, suffering from morbid obesity with a mean age of 46.7 ± 12.4 years, who fulfilled the criteria for bariatric surgery with BMI >37.5 kg/m^2 with associated co-morbidities, all patients underwent Laparoscopic Mini-Gastric Bypass.

Results- Following results were obtained at six months after surgery - mean BMI (46.5 ± 5.9 kg/m^2 to 36.1 ± 4.4 kg/m^2, mean %EWL - 44.04 ± 13.42); co-morbidities such as T2DM (76% to 24%, mean HbA1c - 7.4 ± 1.4 to 6.1 ± 0.7), Hypertension (38% to 0%, mean SBP - 145.6 ± 12.6 mmHg to 123.0 ± 8.1 mmHg, mean DBP - 90.0 ± 6.4 mmHg to 74.8 ± 6.1 mmHg), Dyslipidaemia (50% to 22%, Triglycerides - 208.4 ± 87.5 mg/dL to 141.8 ± 29.6 mg/dL, HDL - 38.0 ± 4.4 mg/dL to 47.8 ± 2.6 mg/dL), minor post-operative complications [diarrhoea(7), bile reflux(2), marginal ulcer(3), nausea(9), GERD(9), all managed conservatively].

Conclusion- Laparoscopic Mini Gastric Bypass is a safe and effective procedure for the treatment of Morbid Obesity with comorbidities such as HTN, Type 2 Diabetes Mellitus and Dyslipidaemia, with a low rate of major postoperative complications.

Keywords- Laparoscopic Mini Gastric Bypass, Morbid Obesity, Type 2 Diabetes Mellitus, Hypertension, Hyperlipidaemia, Weight Reduction, Surgical Treatment.

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INTRODUCTION

Obesity has emerged as one of the most serious public health concerns in the 21st century. The consequences of this chronic disorder are serious. In Obesity, excess body fat accumulates to the extent that it may have a negative impact on health, leading to reduced life expectancy and increased health problems. It can lead to a number of serious and potentially life-threatening conditions which affect essentially every organ system like cardiovascular system (CVS), respiratory, metabolic, musculoskeletal, endocrine, reproductive, dermatological, and neurological. It can also affect the quality of life and lead to psychological problems like low self-esteem or even depression.

World Health Organization (WHO) has declared obesity as a global epidemic. 1/3rd of the global population (about 2.1 billion people) is now overweight or obese, 671 million of which fall into the obese category. It is a leading preventable cause of death worldwide, with increasing rates in adults and children and is seen as one of the most serious public health problems of the 21st century.[1]

According to a study published in the noted journal Lancet, India stands third, just behind US and China in the global hazard list of top 10 countries with the highest number of obese. Obesity is most commonly caused when food calorie intake exceeds energy expenditure over a long period of time, although a few cases are caused primarily due to genetic susceptibility, endocrine disorders, medications or psychiatric illness.

Obesity is a very important factor in the development of type 2 diabetes. This disease is marked by high levels of sugar in the blood and occurs when the body does not respond correctly to insulin, a hormone released by the pancreas. An obese person has double the risk of developing diabetes and a severely obese person is at a tenfold increased risk.[2]

Recent studies show that fat tissues change following bariatric surgery, which leads to improvement of insulin resistance. Bariatric

surgery improves diabetes not only through rapid-weight loss but also by excluding (bypassing) a portion of the small intestine from the flow of nutrients. This means that gastric bypass surgery improves diabetes even before the weight loss. The production of various gut hormones is changed following gastric bypass, leading to improvement of insulin secretion.[3]

Obesity is measured and defined in terms of Quetelet's Body Mass Index (BMI) which is a ratio of weight (kilograms) to height (square meter) of an individual. Normal BMI ranges from 20-25 kg/m^2. BMI > 30 kg/m^2 indicates obesity. A BMI of > 35 kg/m^2 and experiencing obesity-related health conditions or > 40-44.9 kg/m^2 is morbid obesity.

Table 1: Criteria for Obesity

Nutritional Status	WHO-Criteria BMI	Asian-Criteria WPRO
Underweight	<18.5	<18.5
Normal	18.5 - 24.9	18 - 22.9
Overweight	25 - 29.9	23 – 24.9
Pre-Obese	-	-
Obese 1 (Obese)	30 – 34.9	25 – 29.9
Obese 2 (Morbid Obese)	35 – 39.9	>30
Obese 3 (Severe Obese)	>40	
Super Obese	>50	

WPRO - Western Pacific Region of WHO Criteria Pertaining to Obesity (WPRO Criteria, 2000)

Treatment options for obesity include non-surgical treatment and bariatric surgery. The non-surgical treatment is usually a multicomponent approach comprising behavioral therapy, dietary changes with the main aim of reducing energy intake, increasing physical activity, and various pharmacotherapies. The results of medical treatment of obesity have been disappointing. Surgical

techniques for obesity management continue to gain broader implementation possibilities. And despite late introduction as a treatment modality, it is gaining popularity not only as the first step in the staged treatment of super morbid obesity in patients from high-risk groups but mainly as an isolated definitive bariatric procedure. Its increasing popularity among bariatric surgeons and patient's acceptance of its impact on body mass reduction started in 2003.

Surgical intervention in obesity is today the most effective treatment method in high-level obesity management with long-term clinical results and satisfaction of operated patients. A high percentage of patients benefit from bariatric surgery procedures in terms of metabolic effect and substantial body mass index reduction. These procedures improve glucose metabolism leading to the amelioration or complete resolution of type 2 diabetes and alleviation of metabolic syndrome effects. Bariatric surgery interventions not only ensure body weight reduction but also influence lipid and saccharide metabolism as well. Bariatric surgery has been shown to eliminate co-morbid conditions associated with obesity.

Surgical procedures are considered most effective therapy for long-term weight loss. It is a life-saving surgery and not cosmetic surgery. Long-term survival is better in the surgically treated group rather than in those managed medically. Some of these operations lead to the rapid remission of type 2 diabetes and hypertension in a weight loss independent manner. Bariatric Surgery is usually considered when other weight loss efforts have failed. Eligibility criteria were established by the 1991 National Institutes of Health Consensus Development Conference Panel and continue to be the most widely accepted criteria. Selection and exclusion criteria are listed in the following Table 2.[3]

Table 2: Selection and Exclusion Criteria for Bariatric Surgery

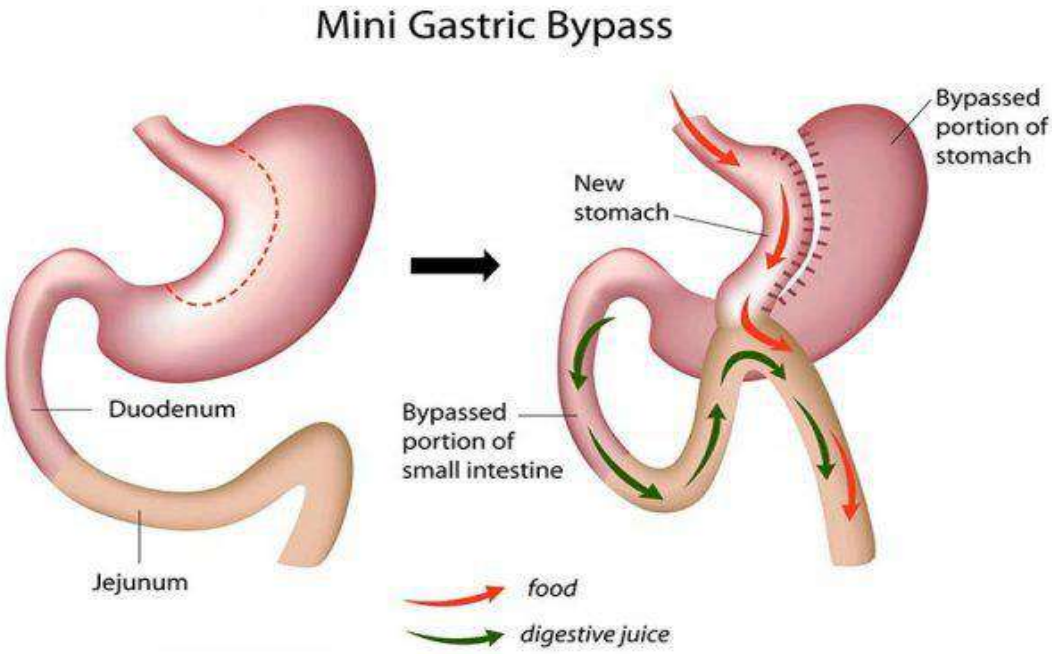
Selection Criteria
Able to adhere to postoperative care (e.g. follow-up visits and tests, medical management, use of dietary supplements)
BMI > 40 kg/m^2
BMI > 35 kg/m^2 with obesity related comorbidity
Previous failed nonsurgical attempts at weight reduction, including non-professional programs (e.g. weight watchers)
Exclusion Criteria
Cardiopulmonary disease that would make the risk prohibitive
Current drug or alcohol abuse
Lack of comprehension of risks, benefits, expected outcomes, alternatives, and required lifestyle changes
Reversible endocrine or other disorders that can cause obesity
Uncontrolled severe psychiatric illness

Christou el al[4](2004) concluded that bariatric surgery not only decreased risk factors, but also decreased overall mortality. They performed a matched cohort study of 1,035 patients who had bariatric surgery with 5,746 obese patients who did not have surgery. Subjects with medical conditions other than morbid obesity were not included. The participants were followed for 5 years. The mortality rate in the treatment group was 0.68% compared with 6.17% of the controls which results in a reduction in the relative risk of death by 89%.

The mini gastric bypass procedure was first developed by Robert Rutledge from the US in 1997, as a modification of the standard Billroth II procedure. A mini gastric bypass creates a long narrow tube of the stomach along its right border (the lesser curvature). A loop of the small gut is brought up and hooked to this tube at about 180 cm from the start of the intestine. The MGB has been suggested as an alternative to the Roux en-Y procedure due to the simplicity of its construction, and is becoming more and more popular because of low risk of complications and good sustained weight loss. It has been

estimated that 15.4% of weight loss surgery in Asia is now performed via the MGB technique.[5]

Figure 1: Mini Gastric Bypass



Operative technique –

An intravenous antibiotic (1 g of third-generation cephalosporin) is administered. The operation is done under general endotracheal anaesthesia. The Laparoscopic Mini Gastric Bypass (LMGB) is performed using five ports with the following steps:

1. Creation of pneumo-peritoneum using veress needle, the needle is inserted in the Palmers point, beneath the left rib arc, in the mid-clavicular line, just beside the arc itself.

2. Ports placement and liver retraction by self-retaining liver retractor.

3. Creation of the gastric pouch using linear staplers; a tunnel behind the posterior gastric wall is created by the harmonic scalpel to incise the hepato-gastric ligament then introduce a 60 mm Endo GIAR 3.5 mm blue cartridge and transected the stomach horizontally. Then, the vertical stomach transection is continued till the gastro-oesophageal junction, using a French calibrating 39 Fr bougie.

4. Exposure of the duodeno-jejunal junction; the ligament of treitz is identified. We started to measure approximately 200–250 cm of

jejunum distally from this point, then a stitch is taken at the anti-mesenteric border of the intestinal loop to facilitate bowel delivery to the gastric pouch.

5. The gastro-jejunal anastomosis; the bowel loop is approximated to the gastric pouch; the Harmonic scalpel is used to make an opening in the small bowel and another in the gastric pouch. Then, anchoring suture is taken through the two openings. Anastomosis is done side to side by 45 mm ETS 3.5 mm white cartridge. The anastomosis is done in a vertical manner to minimize reflux and with a wide stoma to facilitate drainage. Then the stoma opening is closed with two layers continuous sutures using 2/0 absorbable V-lock over a Gastric tube. Leak test is performed through injection of about 50 cc of Methylene blue dye while both afferent and efferent loops were closed by intestinal clamps. Finally, anti-obstruction stitch was taken to anchor the efferent intestinal loop to the distal stomach to avoid its kink or rotation. 28 Fr tube drain was put in the lesser sac.

The One Anastomosis Gastric Bypass has been developed from the Mini Gastric Bypass procedure as originally described by Robert Rutledge. The modification of the original procedure consists of making a latero-lateral gastro-jejunal anastomosis instead of a termino-lateral anastomosis, as is carried out as described in the original procedure.

The rationale for these changes is to try to reduce exposure of the gastric mucosa to biliopancreatic secretions because of their potentially carcinogenic effects with longer term exposure, which is the major criticism of the original technique. If we fix the jejunal loop to the gastric pouch some centimetres up to the gastro-jejunal anastomosis the biliopancreatic secretions have less possibility of coming into the gastric cavity (gravity force). Furthermore, if the anastomosis is latero-lateral this possibility is reduced even more. In addition, the intestinal loop reinforces the staple line against disruption, and also the gastric pouch against dilatation.

Rutledge’s Laparoscopic mini-gastric bypass (LMGB), was proposed as a simple and effective treatment of morbid obesity. However, controversies about the relative efficacy of this procedure

remain, concerning its effect on weight loss, lipid profile, comorbid conditions like type 2 diabetes mellitus and hypertension, and development of post-operative complications.

This study was conducted in the Department of General Surgery in Dayanand Medical College & Hospital to evaluate the changes in the weight/BMI, improvement in diabetic and hypertensive status, changes in the lipid profile and postoperative complications, if any, in patients diagnosed with morbid obesity who underwent Laparoscopic Mini Gastric Bypass Surgery. These patients were followed up on an outpatient basis until 6 months after surgery. In each visit, patient was assessed for weight loss, complications and co-morbidities (diabetes, hypertension, dyslipidaemia, etc).

AIMS AND OBJECTIVES

The aims and objectives of this study were the following:

1. To look for changes in the Weight/BMI of the patients.
2. To look for changes in the Diabetic and Hypertensive status of patients.
3. To look for changes in the Lipid Profile of the patients.
4. To look for post-operative complications in the patients.

REVIEW OF LITERATURE

Obesity has become an epidemic. The world's overweight population is already greater than its underweight population and the numbers of overweight individuals are rapidly on the increase, leading to a global obesity pandemic. Once considered a problem only in high-income countries, overweight and obesity are now dramatically on the rise in all countries.

Laparoscopic Mini Gastric Bypass Surgery research has been limited because of the issues in worldwide acceptance of this technique. Thus the changes in weight, Body Mass Index (BMI), metabolic parameters viz. blood glucose, blood pressure, various lipoproteins and triglycerides following this procedure are compared as regards its efficacy.

Bariatric surgery adequately brings down body weight and resolves obesity related complexities, and is better than different methods for weight loss. Uncommonly, for obesity individuals in prediabetes condition, weight control could bring down the danger or postpone the onset of T2DM, with strict calorie confinement not withstanding turning around the movement of T2DM in set up patients. Laparoscopic adjustable gastric banding (LAGB), laparoscopic sleeve gastrostomy (LSG), and laparoscopic Roux-en-Y gastric bypass (LRYGB) are the three most usually utilized bariatric surgeries and LRYGB, went with more fast and more significant weight reduction than "restrictive" strategy (LAGB) and less danger of disappointment or intricacy than the "malabsorptive" method (LSG), is for the most part considered as the "gold standard" procedure.

Laparoscopic mini-gastric bypass (MGB), initially revealed by Rutledge, was proposed as a straight forward and successful treatment of morbid obesity. A few clear points of interest of the MGB contrasted and the best quality level LRYGB are single anastomosis, shorter expectation to absorb information, less inner imperfections for herniation and simplicity of modification or inversion. In the meantime, concerns identifying with the symptomatic biliary reflux and the danger

of gastric/oesophageal tumor have kept it across the board adoption. The aim of this study was to prospectively evaluate the changes in weight, BMI, glucose, HbA1c, blood pressure and lipid profile before MGB and at 0, 3 & 6 months postoperatively.

Brethauer et al[6] conducted a study to provide guidance to authors and editors who write, review, and publish manuscripts focusing on bariatric and metabolic surgery. In addition to providing consistency within the field of bariatric and metabolic surgery, standardized outcome reporting provides a uniform method of communicating the findings throughout the medical literature. Mentioned below is the executive summary of American Society for Metabolic and Bariatric Surgery (ASMBS) outcome reporting standards (Table 3-7).

Weight Loss

Reporting of weight loss outcomes after bariatric surgery should include the following parameters (in which initial weight is the patient's weight as measured closest to the time of surgery and initial BMI is the body mass index (BMI) determined closest to the time of surgery in the preoperative period):

Complete reporting is recommended as follows:

1. Mean Initial BMI of the Cohort
2. Change in BMI (ΔBMI): ΔBMI = (Initial BMI) – (Postop BMI)
3. Percent of Total Weight Loss (%TWL):

%TWL = [(Initial Weight) – (Postop Weight)]/[(Initial Weight)] x 100

4. Percent Excess BMI Loss (%EBMIL):

%EBMIL = [ΔBMI/(Initial BMI – 25)] x 100

and/or

Percent Excess Weight Loss (%EWL)

%EWL = [(Initial Weight) – (Postop Weight)]/[(Initial Weight) – (Ideal Weight)] x 100

(in which ideal weight is defined by the weight corresponding to a BMI of 25 kg/m^2.

Type 2 Diabetes Mellitus

Table 3: Definitions of Glycemic Outcomes After Bariatric Surgery

Outcome	Definition
Remission (complete)	Normal measures of glucose metabolism (HbA1c < 6%, FBG < 100 mg/dL) in the absence anti-diabetic medications
Remission (partial)	Sub-diabetic hyperglycemia (HbA1c 6%–6.4%, FBG 100–125 mg/dL) in the absence antidiabetic medications
Improvement	Statistically significant reduction in HbA1c and FBG not meeting criteria for remission or decrease in anti-diabetic medications requirement (by discontinuing insulin or one oral agent, or ½ reduction in dose)
Unchanged	The absence of remission or improvement as described earlier
Recurrence	FBG or HbA1c in the diabetic range (≥ 126 mg/dL and ≥ 6.5%, respectively) or need for antidiabetic medication after any period of complete or partial remission

Hypertension

Stage of hypertension before and after bariatric surgery at the defined follow-up intervals are as follows:

Pre-Hypertension (120–140/80–89 systolic/diastolic)

Stage 1 Hypertension (140–159/90–99)

Stage 2 Hypertension (> 160/ > 100)

Anti-hypertensive medication use should be reported (clearly define indication for medication as treatment of hypertension). Reporting medication type or class and duration of therapy is also recommended with the understanding that this may not be feasible in retrospective studies.

Table 4: Definitions of Hypertension Outcomes After Bariatric Surgery

Improvement:	Defined as a decrease in dosage or number of anti-hypertensive medication or decrease in systolic or diastolic blood pressure (BP) on the same medication (better control).
Partial remission:	Defined as pre-hypertension values (120–140/80–89) when off medication.
Complete remission:	Defined as being normotensive (BP < 120/80) off anti-hypertensive medication. If medication such as beta-blockade is used for another indication (atrial fibrillation), this needs to be clearly described but cannot be included as complete remission because of the dual therapeutic effect of some medications.

Hyperlipidaemia

It is recommended that reporting practice for dyslipidaemia after bariatric surgery follow the Adult Treatment Panel III Guidelines, 2001, of the National Heart, Lung and Blood Institute. These values reflect fasting blood samples:

Table 5: Definitions of Hyperlipidemia Outcomes After Bariatric Surgery (A)

LDL Cholesterol	<100 mg/dL = optimal (or < 40 mg/dL if another risk factor is present) 100–129 mg/dL = near optimal 130–159 mg/dL = borderline high 160–189 mg/dL = high > 190 mg/dL = very high
HDL Cholesterol	<40 mg/dL = low >60 mg/dL = high
Total Cholesterol	<200 mg/dL = desirable 200–239 mg/dL = borderline high >240 mg/dL = high
Triglycerides	<150 mg/dL = normal 150–199 mg/dL = borderline high 200–499 mg/dL = high > 500 mg/dL = very high

Table 6: Definitions of Hyperlipidemia Outcomes After Bariatric Surgery (B)

Improvement	Decrease in number or dose of lipid-lowering agents with equivalent control of dyslipidemia or improved control of lipids on equivalent medication. Authors must specify which components of the lipid profile are being studied and report them as individual outcomes when possible. Cardiovascular risk based on total cholesterol (TC)/HDL or other risk scoring systems can be used to provide a more global assessment of lipid changes after surgery.
Remission	Normal lipid panel (or specific component being studied) off medication

Complications

Table 7: Complications After Bariatric Surgery

Complication	Major	Minor
Early < 30 Days	Early Major	Early Minor
Late > 30 Days	Late Major	Late Minor

Major complications include any complication that result in a prolonged hospital stay (beyond 7 days), reintervention, or reoperation.

Minor complications include everything else that is not included under major.

Examples of major complications include the following

- Venous thrombotic event (VTE) requiring administration of anti-coagulant or intervention, such as embolectomy, inferior vena caval (IVC) filter
- Anastomotic leak requiring reoperation, percutaneous drainage of abscess, stent placement or conservative management with parenteral nutrition and nothing per oral (NPO)

- Gastrointestinal haemorrhage requiring transfusion or intervention
- Small bowel obstruction requiring reoperation
- Bowel perforation requiring reoperation
- Trocar site hernia requiring reoperation
- Death
- Myocardial infarction
- Cerebrovascular accident
- Renal failure requiring dialysis
- Respiratory failure requiring intervention such as intubation
- Prolonged hospitalization (> 7 d)
- Chronic nausea and vomiting not responsive to conservative management and requiring total parenteral nutrition (TPN)
- Gastric sleeve stenosis/obstruction requiring revision to a gastric bypass
- Surgical site infection (superficial, deep, or organ space) requiring debridement or washout in the operating room or percutaneous intervention
- Small bowel stenosis, stricture, or obstruction requiring revision of the jejuno-jejunostomy

Examples of minor complications include the following:

- Marginal ulcer diagnosed with upper endoscopy
- Anastomotic stricture requiring endoscopic dilation
- Nausea and vomiting requiring intravenous fluids (IVF) but not TPN
- Acute renal failure managed with IVF without the need of dialysis
- Gastrointestinal ileus managed conservatively
- Incisional hernia (diagnosed during routine follow-up)
- Trocar site surgical site infection managed with drainage and local wound care
- Negative re-exploration (e.g., diagnostic laparoscopy to rule out leak or for unexplained tachycardia)

- Urinary tract infection managed with antibiotics
- Dehydration requiring IV hydration as an inpatient
- Vitamin or mineral deficiency requiring IV supplementation (e.g., severe anemia requiring IV iron infusion or severe vitamin B12 requiring vitamin B12 injections or symptomatic thiamine deficiency requiring IV thiamine)
- Nephrolithiasis
- Symptomatic cholelithiasis

Marco et al[7] study undertaken to prospectively evaluate the effect of different types of bariatric surgery on lipid profile in which Total cholesterol (TC), High-Density Lipoprotein cholesterol (HDLc), Low-Density-Lipoprotein cholesterol (LDLc) and Triglycerides (TG) levels were evaluated before surgery and at 3 different post-operative time-points (3, 6 and 12 months) in consecutive obese subjects undergoing mini-gastric bypass (MGB) or sleeve gastrectomy (SG). During the post-operative follow-up, both MGB and SG subjects showed significant changes in lipid profile. However, at 3 months, MGB patients showed higher changes in TC (β=0.179, p=0.022) and TG (β=0.265, p=0.001) than those undergoing SG. At 6-month post-operative follow-up, these differences were confirmed only for TC. After a 12-month follow-up, MGB and SG were entirely comparable for changes in lipid profile with the exception of HDLc, whose changes were higher in SG group (β=0.130, p=0.039). Overall, the probability to normalize lipid profile during the 12-month follow-up was similar in MGB and in SG patients (OR: 1.24, 95% CI: 0.41-3.76, p=0.689). Despites some differences at 3-6 post-operative months, during a 12-month follow-up, SG and MGB showed a similar efficacy in the improvement of lipid profile of obese patients.

Halil et al[8] studied the efficacy of Laparoscopic Mini-Gastric Bypass for Type 2 Diabetes Mellitus in Obese Patients in the Bezmialem Preliminary Report and found significant reduction in the HbA1c levels from 9.8% to 6.2%.

An Italian study carried out by Musella et al[9] on 974 patients who underwent laparoscopic mini gastric bypass found it to be a short, simple, low-risk, effective, and durable bariatric procedure.

Yingjun et al[10] studied the efficacy of Laparoscopic mini gastric bypass for obesity and Type 2 Diabetes Mellitus found it to be effective in weight loss and T2DM remission.

Lee et al[11] evaluated the effect of laparoscopic mini gastric bypass for type 2 diabetes mellitus in patients with BMI < 35 kg/m^2 resulted in significant and sustained weight loss with successful treatment of T2DM upto 87.1%. Patients with BMI <35 still had an acceptable DM resolution and this option can be offered to this group of patients.

Zisun et al[12] study done to evaluate the efficacy and safety of LMGB in non-obese T2DM patients (BMI 25-30 kg/m^2) demonstrated the resolution of hyperglycaemia in 70 % of non-obese T2DM patients (BMI 25-30 kg/m^2).

Asawer et al[13] study done for the effects of laparoscopic mini gastric bypass on weight loss and biomarker parameters in morbidly obese patients revealed significant reduction in FBG, HbA1c, cholesterol, TG, LDL and VLDL ($p<0.001$) and significant increase in HDL level ($p< 0.001$).

Rutledge[14] conducted a study to determine the rates and indications for inpatient hospital use before and after mini gastric bypass in comparison to similar rates in Roux-En-Y demonstrated hospitalisation following Mini Gastric Bypass Surgery decreased by 1/3rd, instead of rising. The study supported Mini Gastric Bypass as a low risk procedure that decreases the need for hospitalization.

Another study conducted by Lee et al[15] to compare the safety and effectiveness of laparoscopic Roux-en-Y gastric bypass (LRYGBP) and laparoscopic mini-gastric bypass (LMGBP) in the treatment of morbid obesity found that there was one conversion (2.5%) in the LRYGBP group. Operation time was shorter in LMGBP group (205 versus 148, $P < 0.05$). There was no mortality in each group. The operative morbidity rate was higher in the LRYGBP group (20% versus

7.5%, $P < 0.05$). The late complications rate was the same in the 2 groups (7.5%) with no reoperation. The percentage of excess weight loss was 58.7% and 60.0% at 1 and 2 years, respectively, in the LRYGBP group, and 64.9% and 64.4% in the LMGBP group. The residual excess weight <50% at 2 years postoperatively was achieved in 75% of patients in the LRYGBP group and 95% in the LMGBP group ($P < 0.05$). A significant improvement of obesity-related clinical parameters and complete resolution of metabolic syndrome in both groups were noted. Both gastrointestinal quality of life increased significantly without any significant difference between the groups.

Johnson et al[16] carried out a retrospective multicentre review to identify MGB patients who require or required revisional surgery at 5 hospitals within the region of the United States where the MGB procedure originated to assess the claim that revision to RYGB is rarely needed. He found that a total of 32 patients were identified who presented with complications after undergoing the MGB procedure and required revisional surgery. The complications included gastrojejunostomy leak in 3, bile reflux in 20, intractable marginal ulcer in 5, malabsorption/malnutrition in 8, and weight gain in 2. Of the 32 patients, 21 required conversion to RYGB and an additional 5 have planned revisions in the future. Also, 2 patients were treated with Braun entero-enterostomies and 4 required 1 or more abdominal explorations. The results of this preliminary review confirmed that MGB does require revision in some patients and that conversion to RYGB is a common form of revision.

Pazouki et al[17] compared course of weight loss following Laparoscopic Mini Gastric Bypass or Roux En Y Gastric Bypass surgery, after one year of follow up. This randomised controlled trial was conducted among obese patients admitted to Rasoul Akram Hospital Obesity Clinic, half underwent laparoscopic Roux En Y Gastric Bypass surgery and the rest were undergoing laparoscopic mini gastric bypass. 75 obese patients were studied. Most of the participants were female (82.7%). Participants aged between 18 and 59 years old (average = 36.8 $\pm$ 9.8 yrs). Before the surgery, there was no significant

difference in weight between the two groups. Excessive weight loss after one month, six months, nine months, and one year between the two groups was significant and was more in the mini gastric bypass ($p < 0.05$).

Carbajo et al[18] (2018) conducted a prospective, single-center observational study to analyze weight evolution in 100 patients from the first pre-surgery appointment through a 2-year follow-up after one anastomosis gastric bypass. No surgical complications were observed in the patients studied. The patients' mean pre-surgery BMI was 42.61 ± 6.66 kg/m2. Greatest weight loss was observed at 12 months postsurgery (68.56 ± 13.10 kg). Relative weight loss showed significant positive correlation, with greatest weight loss at 12 months and %excess BMI loss > 50% achieved from the 3-month follow-up in 92.46% of patients. The authors reported that in this series of patients, 48% of patients had normal weight (BMI > 18.5 < 25 kg/m2) at 24 months postsurgery. A limitation of this study is the short-term follow-up of the sample selected; patient evolution should be completed with medium- and long-term data. In addition, a possible bias to consider is non-randomization of patients.

In a prospective, observational and descriptive study of 150 morbidly obese patients who underwent laparoscopic one anastomosis gastric bypass, lipid profiles were evaluated preoperatively and at different intervals during a 2-year follow-up. The authors (Carbajo et al[19], 2017) reported a mean weight loss of 48.85 kg ± 15.64 and mean % excess weight loss of 71.87 ± 13.41. kg. Total cholesterol and low density lipoprotein (LDL) levels significantly decreased and high density lipoprotein (HDL) levels significantly increased which the authors believe translate into theoretical relevant cardiovascular risk benefits. Long-term randomized studies are needed to fully evaluate the impact of this procedure.

Kansou et al[20] (2016) retrospectively evaluated one year outcomes for patients who underwent either a sleeve gastrectomy (n=261) or LMGBP (n=161) as an alternative to a Roux-en-Y gastric bypass. At one year, rate of follow-up was 88.4%. Main outcome was%

of Total Weight Loss (%TWL) at one year. Propensity score matching and multivariable analyses were used to compensate for differences in some baseline characteristics. After matching sleeve gastrectomy (N = 136) and LMGBP (N = 136) groups did not differ for initial BMI, % of female patients, age (years) and diabetes. At one year, %TWL, change in BMI and rate of stenosis were higher for the LMGBP group, respectively: 38.2 ± 8.4 vs. 34.3 ± 8.4 (P < 0.0001); -16.5 ± 4.6 vs. -14.9 ± 4.4 (P = 0.005) and 16.9% vs. 0% (P < 0.0001). In multivariate analyses (β coefficient), LMGBP was a positive independent factor of % TWL (2.8; P = 0.008). The authors concluded that LMGBP appears to have better weight loss at one year compared to sleeve gastrectomy, with higher gastric complications.

Lessing et al[21] (2017) conducted a retrospective analysis of all patients (n=407) who underwent one anastomosis gastric bypass (OAGB), reporting an average excess weight loss 1 year following surgery as 88.9 ± 27.3 and 72.8 ± 43.5% in patients that underwent primary and revision OAGB, respectively. Study limitations include single center data analysis and non-randomization.

Musella et al[22] (2017) retrospectively evaluated complications of 2678 patients who underwent a mini/one anastomosis gastric bypass (MGB/OAGB). Follow-up at 5 years was 62.6%. Intraoperative and early complication rates were 0.5 and 3.1%, respectively. The late complication rate was 10.1%. A statistical correlation was found for postoperative duodenal-gastro-esophageal reflux (GERD) in patients with pre-existing GERD or with a gastric pouch shorter than 9 cm. The authors conclude that MGB/OAGB is a reliable bariatric procedure in comparison with more mainstream procedures (Roux-en-Y gastric bypass and laparoscopic sleeve gastrectomy). Additional long-term outcomes are needed to evaluate this procedure.

Obese patients who underwent either a LMGBP (n=169) or SG (n=118) were retrospectively analyzed by Plamper et al[23] (2017) for short-term for perioperative and early postoperative outcomes. Both groups were comparable for BMI at baseline (MGB = 54.1 kg/m2 vs. SG = 54.6 kg/m2, p = 0.657). Mean operation time (81.7 vs. 112.1 min,

p < 0.0001) as well as hospital stay was lower in the MGB-group (4.5 vs. 7.2 days, p < 0.0001). Perioperative (30 days) mortality was 0% in MGB versus 0.8% in SG (one patient). Perioperative complication rate was also lower in the MGB-group (3.0 vs. 9.3%, p = 0.449). %EWL was significantly better after 1 year in MGB: 66.2% (±13.9%) versus 57.3% (±19.0%) in SG (p < 0.0001), as well as BMI which was 34.9 kg/m2 (±4.8 kg/m2) in MGB versus 38.5 kg/m2 (±8.6 kg/m2) in SG (p = 0.001). The authors concluded that MGB achieved superior weight loss at 1 year and had a lower 30-day complication rate in comparison with SG for super-obese patients.

Wang et al[24] (2017) conducted a systematic review and meta-analysis to compare the safety and efficacy between laparoscopic mini-gastric bypass (MGB) and laparoscopic sleeve gastrectomy (SG). Thirteen studies met the inclusion criteria of comparative studies between MGB and SG; patients were adults, with age ranging from 20 to 70 years old; at least one of the following endpoints was included: operation time, mortality, overall early complications, specific early complications, overall late complications, specific late complications, hospital stay, revision rate, remission rate of comorbidities,1-year %EWL or 5-year %EWL. The authors observed that patients receiving mini-gastric bypass had more advantageous indexes than patients receiving sleeve gastrectomy, such as higher 1-year EWL% (excess weight loss), higher 5-year EWL%, higher T2DM remission rate, higher hypertension remission rate, higher obstructive sleep apnea (OSA) remission rate, lower osteoarthritis remission rate, lower leakage rate, lower overall late complications rate, higher ulcer rate, lower GERD rate, shorter hospital stay and lower revision rate. No significant statistical difference was observed on overall early complications rate, bleed rate, vomiting rate, anemia rate, and operation time between mini-gastric bypass and sleeve gastrectomy. In their opinion, due to the biased data, small sample size and short follow-up time, the results of this review may be unreliable. RCTs with larger samples sizes are needed to compare the effectiveness and safety between mini-gastric bypass and sleeve gastrectomy.

Piazza et al[25] (2015) reported their experience with laparoscopic mini-gastric bypass (LMGB) as a revisional procedure for failed primary laparoscopic adjustable gastric banding (LAGB). From June 2007 to November 2012, 48 patients, who had undergone LAGB, underwent revisional surgery to LMGB. The revisions to a mini-gastric bypass (MGB) were completed laparoscopically in all cases except in four, when the MGB was deferred because of gastric tube damage. Mean age was 38 years (range 20-59) and BMI was 43.4 ± 4.2 kg/m(2); 82% of patients were females. Revision was performed after a mean of 28.6 months. The mean hospital stay was 3.25 days. Within 60 days of the MGB, mortality and morbidity were nil. They observed a significant difference in mean BMI after 6 months' follow-up ($P < 0.001$). Diabetes remission was observed in 88% of patients, apnea remission in 66%, and hypertension remission in 66% after LMGB ($p < 0.001$). Moreover, four patients with GERD reported symptom resolution. All LAGB patients had positive outcomes after the conversion to MGB, with a mean gain of 1.7 points in the bariatric analysis and reporting outcome system questionnaire. The authors suggest that based on their results, LMGB is a safe, feasible, effective and easy-to-perform revisional procedure for failed LAGB.

Carbajo et al[26] conducted a study to evaluate the technique, results and long-term follow-up in 1200 patients undergoing Laparoscopic One-Anastomosis Gastric Bypass and found excess weight loss was 88% (at 2 years), then 77 and 70%, 6 and 12 years postoperatively. Mean BMI (kg/m^2) decreased from 46 to 26.6 and was 28.5 and 29.9 at those time frames.

Wang W et al[27] conducted a study to evaluate the short-term results of laparoscopic mini-gastric bypass in 423 patients and observed that the mean age was 30.8 years, preoperative mean weight 120.3 kg and mean BMI 44.2 kg/m2. Mean BMI decreased to 29.2 and 28.4 kg/m2 at 1-year and 2-year follow-up, with mean excess weight loss 69.3% and 72.2%. The study also concluded that LMGB has a low

complication and mortality rate. The learning curve is less steep than for LRYGB, whereas the efficacy is similar.

The study by Rutledge[28] having the first 1,274 patients who underwent the Mini Gastric Bypass revealed mean excess weight loss was 51% at 6 months, 68% at 12 months and 77% at 2 years. The mean operating-time was 36.9 ± 33.5 minutes. The shortest time was 19 minutes. Hospital stay was 1.5 ± 1.6 days. The overall complication rate has been 5.2%. The overall rate of deep vein thrombosis and pulmonary embolism was 0.08% and 0.16% respectively. The leak rate was 1.6%. There was one hospital death, 0.08%. Associated medical illnesses were either completely reversed or markedly improved, thus meeting many of the criteria of an "ideal" weight loss operation.

Abdallah et al[29] conducted a study to evaluate the technique of laparoscopic mini gastric bypass for metabolic syndrome patients on thirty patients and concluded that BMI and waist circumference were significantly reduced post-operatively; also co-morbidities T2DM, hypertension and dyslipidaemia were resolved or controlled. No mortality was reported within 30 days of surgery.

Noun et al[30] conducted a study on one thousand consecutive Mini-Gastric Bypass patients to see the short and long-term outcome and found out that excessive weight loss occurred in four patients; two were reversed and two were converted to sleeve gastrectomy. Maximal percent excess weight loss (EWL) of 72.5% occurred at 18 months. Weight regain subsequently occurred with a mean variation of −3.9% EWL at 60 months. The 50% EWL was achieved for 95% of patients at 18 months and for 89.8% at 60 months.

Another study by Piazza et al[31] to find an ideal operation amongst the elevated variety of procedures proposed for surgical treatment of obesity found LMGB to be an attractive alternative: shorter operative time, with less morbidity and mortality, easier to teach and to perform. Another advantage was the presence of a single anastomosis alone reducing the possibility of leaks. Significant reduction of BMI and percentage of excess weight after surgery with a significant improvement in obesity-related comorbidities including

blood pressure, hyperglycaemia, blood lipid, uric acid, and liver function was also observed.

Chakhtoura et al[32] conducted a study to look for primary results of Laparoscopic Mini-Gastric Bypass in a French Obesity-Surgery Specialized University Hospital and found LMBG as a good alternative to LRYGB, giving the same results with a more simple and reproductible technique.

Rutledge et al[33] conducted a six-year study in 2,410 patients to evaluate the results with the mini-gastric bypass and observed the average operative time was 37.5 minutes, and the median length of stay was 1 day. The 30-day mortality and complication rates were 0.08% and 5.9% respectively. The leak rate was 1.08%. Average weight loss at 1 year was 59 kg (80% of excess body weight). The most frequent long-term complications were dyspepsia and ulcers (5.6%) and iron deficiency anaemia (4.9%). Excessive weight loss with malnutrition occurred in 1.1%. Weight loss was well maintained over 5 years, with <5% patients regaining more than 10 kg. Thus, overall, the MGB is very safe initially and in the long-term. It has reliable weight loss and complications similar to other forms of gastric bypass.

Peraglie et al[34] conducted a study to evaluate the outcomes of Laparoscopic Mini Gastric Bypass in 16 super super obese patients which revealed 72 kg weight loss or 65% EWL at 2 years which showed a consistent increase over the follow-up period.

Sampalis et al[35] studied the impact of weight reduction surgery on health-care costs in morbidly obese patients. Patients having undergone bariatric surgery had significant reductions in mean percent initial excess weight loss (67.1%, P <0.001) and in percent change in initial body mass index (34.6%, P <0.001). Bariatric surgery patients had higher total costs for hospitalizations (per 1,000 patients) in the first year following cohort inception (surgery cohort = CDN 12,461,938 dollars; control cohort = CDN 3,609,680 dollars). At 5 years after cohort inception, average cumulative costs for operated patients were CDN 19,516,667 dollars versus CDN 25,264,608 dollars, for an absolute difference of almost CDN 6,000,000 dollars per 1,000 patients. They

concluded that weight reduction surgery in morbidly obese patients produces effective weight loss and decreases long-term direct health-care costs.

Jammu et al[36] conducted a 7-year prospective study with 339 laparoscopic sleeve gastrectomy (LSG), 295 Roux-en-Y gastric bypass (RYGB), and 473 mini-gastric bypass (MGB) to determine an effective and safe bariatric and metabolic procedure. Mortality rate was 2.1% in LSG, 0.3% in RYGB, and 0% in MGB. Leaks were highest in LSG (1.5%), followed by RYGB (0.3%), and zero in MGB. Bile reflux was seen in <1% in the MGB series. Persistent vomiting was seen only in LSG. Weight regain was 14.2% in LSG, 8.5% in RYGB, but 0% in MGB. Hypoalbuminemia was minimal in LSG, 2.0% in RYGB, and 13.1% in MGB (in earlier patients where bypass was >250 cm). The following resolution of comorbidities: dyslipidaemia, type 2 diabetes (T2D), hypertension, and percent excess weight loss (%EWL) was maximum in MGB. GERD was maximum in LSG (9.8%), followed by RYGB (1.7%), and minimal in MGB (0.6%). They concluded that RYGB and MGB act on the principle of restriction and malabsorption, but MGB superseded RYGB in its technical ease, efficacy, revisibility and reversibility. Mortality was zero in MGB. %EWL and resolution of comorbidities were highly significant in MGB. Based on this, they suggested that MGB is the effective and safe procedure for patients who are compliant in taking their supplements. LSG may be done in non-compliant patients and those ready to accept weight regain.

Peraglie et al[37] conducted a study to evaluate the results of laparoscopic mini-gastric bypass in patients age 60 and older with follow-up to 6 years. From 2007-2013, a total of 758 LMGBs were performed by one surgeon (CP). Eighty-eight (12%) were ≥60 years old, with 62% female. Mean age of this cohort at operation was 64 (60-74), and mean weight and BMI were 118 kg (78-171) and 43 kg/m(2) (33-61), respectively. Comorbidities were present in all patients, and one-third had previous abdominal operations. All patients underwent LMGB, without conversion to open. Mean operative time was 70 min (43-173). Only one patient required overnight ICU admission. Average

length of stay was 1.2 days (1-3). Overall complication rate was 4.5% (all minor); there were no major complications. Readmission rate was 1.2% (one patient). There was no surgical-related mortality. Follow-up to 90 days was 89%, but steadily declined to 42% at 6 years (72 months). The %EWL was 72% at 72 months. They concluded that LMGB can be safely performed with good weight loss in patients ≥60 years old, despite numerous comorbidities and previous abdominal operations.

Disse et al[38] conducted a comparative study between the omega loop bypass (OLB) compared to Roux-en-Y gastric bypass. Among the 20 OLB and 61 RYGBP patients, it was observed that mean excess BMI loss percent (EBL%) at 6 months and at 1 year was greater in the OLB group (76.3 vs. 60.0%, $p = 0.001$, and 89.0 vs. 71.0%, $p = 0.002$, respectively). After adjustment for age, sex, initial BMI, and history of previous bariatric surgery, the OLB procedure was associated with a significantly greater 1-year EBL%. Diabetes improvement at 6 months was similar between both groups. The early and late complication rates were not statistically different. There were three anastomotic ulcers in the OLB group, in smokers, over 60 years old, who were not taking proton pump inhibitor medication. They concluded that there was a greater weight loss with OLB and similar efficiency on metabolic control compared to RYGBP.

Carbajo et al[39] reported a case of a 12 year old patient with super obesity (58.5 kg/m^2 of BMI) and metabolic syndrome who underwent LOAGB and monitored during the last 5 year. The patient after five years follow-up maintained a 22.4 kg/m^2 of BMI, thus proving the efficacy and safety of LMGB as a treatment of obesity and comorbidities as well, for adolescent patients.

Similarly, Carbajo et al[40] carried out another research between January 2010 an May 2012, in which 415 patients were included in the European Accreditation Council for Excellence Centers for Bariatric Surgery (EAC-BS) database, from which 79 patients with a glycaemic level disturbance in the preoperative blood sample were chosen. Of this group, 47 patients were pre-diabetic (fast plasma glucose ≥ 110

mg/dl ≤ 125 mg/dl) and glycosylated haemoglobin (HbA1c) levels between 5.7-6.4% and 32 were diabetic (fast plasma glucose ≥ 126 mg/dl) and glycosylated haemoglobin (HbA1c) levels ≥ 6.5%. They described the weight evolution, the excess body mass index lost percentage (%EBMIL), the glycaemia and the glycosylated haemoglobin levels, and reported regular laboratory controls during the first year after surgical intervention. The study revealed both patient groups achieved their lowest mean weight loss 12 months after surgery, being average weight in the pre-diabetic group 62,41 ± 10,93 and 68,36 ± 11,16 in the diabetic group. Since 3 months after surgery, pre-diabetic patients achieve a mean BMI < 30, according to the Spanish Society for Obesity Study (SEEDO 2007), this amount is outside of the definition of obesity. Not being the case of the diabetic patients who don´t achieve this result until 6 months after surgery. The weight loss was excellent in both study groups, achieving an excess body mass index loss percentage (% EBMIL) greater than 65%, since the first three-month postoperative control. Glycemia levels descend in both groups, achieving the pre-diabetic group a mean glycemia level of < 110 mg/ dl in the second day after LOAGB surgery. Pre-diabetic patients maintain more stable glycemia with better controls, and very favourable outcomes 12 months after surgery. The diabetic patients achieve the mean glycemia level of < 110 mg/dl at the first month after surgery and maintained it 12 months after surgery which is the time of this study. The glycosylated haemoglobin levels descended in both groups, achieving levels of 4% three months after surgery in the prediabetic group and 4.8% at six months in the diabetic group, thus concluding LOAGB to be an efficient bariatric technique for complete remission of pre-diabetes and diabetes mellitus type 2 and also with the excess weight loss resolution.

Another study was conducted by Garcia-Caballero et al[41] to investigate if the same principles of bariatric surgery that improve diabetes in obese patients, could be applied to non obese normal weight diabetics. Thirteen diabetic patients operated by One Anastomosis Gastric Bypass (BAGUA), were evaluated in the

preoperative period and 1, 3 and 6 months after surgery. Body weight and composition, Fasting Plasma Glucose, HbA1c levels, blood pressure and serum lipids levels were analysed, as well as the monitoring of the immediate postoperative treatment necessities for Diabetes and other metabolic syndrome comorbidities. After the surgery the 77% of the patients resolves its T2DM, 46% from surgery, and rest noted an significant improvement of the disease in spite of having a C peptide level near to zero some of the patients. The comorbidities, mainly hypertension and lipid abnormalities experience improvement early. All patients reduce their weight and the amount of fat mass until values consistent with their age and height, thus concluding that the One Anastomosis Gastric Bypass leads to resolution or improvement of T2DM in non obese normal weight patients.

Milone et al[42] conducted a study to find out the effectiveness of sleeve gastrectomy and mini-gastric bypass on diabetes remission. Data from patients referred during a 3-year period (from January 2009 to December 2011) to the University of Naples “Federico II” diagnosed with obesity and diabetes were retrieved from a prospective database. The patients were split into two groups according to the surgical intervention performed [sleeve gastrectomy (SG) and mini-gastric bypass (MGB)]. Weight loss and glycemic control status (blood glucose, HbA1c and hypoglycaemic treatment) were evaluated. A total of 53 subjects who underwent sleeve gastrectomy or mini-gastric bypass for obesity and diabetes were screened for the inclusion in this study. Of these, 4 subjects were excluded because of surgical complications, 7 subjects were omitted because young surgeons conducted the operations and 11 subjects were removed because of the lack of follow-up. Thirty-one obese patients were recruited for this study. A total of 15 subjects underwent SG (48.4%), and 16 underwent MGB (51.6%). After adjusting for various clinical and demographic characteristics in a multivariate logistic regression analysis, high hemoglobin A1c was determined to be a negative predictor of diabetes remission at 12 mo (OR = 0.366, 95%CI: 0.152-0.884). Using the same

regression model, MGB showed a clear trend toward higher diabetes remission rates relative to SG (OR = 3.780, 95%CI: 0.961-14.872).

Georgiadou et al[43] conducted a systematic review to summarize the available evidence about the efficacy and safety of LMGB. A systematic search in the literature was performed, and PubMed and reference lists were scrutinized (end-of-search date: July 15, 2013). For the assessment of the eligible articles, the Newcastle-Ottawa quality assessment scale was used. Ten eligible studies were included in this study, reporting data on 4,899 patients. According to all included studies, LMGB induced substantial weight and body mass index reduction, as well as substantial excess weight loss. Moreover, resolution or improvement in all major associated medical illnesses and improvement in overall Gastrointestinal Quality of Life Index score were recorded. Major bleeding and anastomotic ulcer were the most commonly reported complications. Readmission rate ranged from 0%-11%, whereas the rate of revision operations ranged from .3%- 6%. The latter were conducted due to a variety of medical reasons such as inadequate or excessive weight loss, malnutrition, and upper gastrointestinal bleeding. Finally, the mortality rate ranged between 0% and .5% among primary LMGB procedures. Thus, they concluded that LMGB represents an effective bariatric procedure; its safety and minimal postoperative morbidity seem remarkable.

Bruzzi et al[44] conducted a research to study the 5-year results of 175 patients who had undergone LMGB between October 2006 and October 2008 at the University Public Hospital, France. Complete follow-up was available in 126 of 175 patients (72%) who had LMGB. Mortality, morbidity, weight loss, co-morbidities, and quality of life were assessed. Weight loss was determined as a change in body mass index (BMI) and percent excess BMI loss (%EBMIL). Quality of life in the treatment group was analysed using the Gastrointestinal Quality of Life Index (GIQLI) and was compared with a retrospectively case matched preoperative control group. They observed that there were no deaths. Thirteen patients (10.3%) developed major complications. Marginal ulcers occurred in 4% of patients. Incapacitating biliary reflux

developed in 2 (1.6%) who required conversion into RYGB. Gastric pouch dilation occurred in 4 patients (3.2%) and inadequate weight loss with severe malnutrition in 2 (1.6%). At 5 years, mean BMI was 31 ± 6 kg/m^2 and mean %EBMIL was 71.5% ± 26.5%. Postoperative GIQLI score of the treatment group was significantly higher than preoperative score of the control group (110.3 ± 17.4 versus 92.5 ± 15.9, P<.001). Social, psychological, and physical functions were increased significantly. No significant differences were found in gastroesophageal reflux or diarrhoea symptoms between the 2 groups. Long-term follow-up showed an improvement in all co-morbidities, thus proving that LMGB is effective in providing a good quality of life results at 5 years after surgery.

MATERIALS AND METHODS

This was a retrospective and prospective study which was conducted in DMC&H, Ludhiana, on 50 Morbidly Obese patients aged 46.7 ± 12.4 years, who were admitted during 2015 to 2018, to monitor the changes in BMI, Diabetic & Hypertensive Status, Lipid Profile and Post Operative Complications, after undergoing Laparoscopic Mini Gastric Bypass Surgery for Morbid Obesity. This report presents the results of examined patients in 6 months after the operation. The interpretation was done on the basis of changes in the Body Mass Index, Fasting Blood Sugar, HbA1c, Systolic and Diastolic Blood Pressure readings and Lipid Profile in these patients.

INCLUSION CRITERIA

- Morbid Obesity [BMI > 40 kg/m^2]
- BMI >37.5 kg/m^2 with co-morbidities viz. Diabetes, Hypertension, Cardiovascular Disease, Hyperlipidemia.
- Failure with regimen of diet, physical activity and behavior therapy, for at least 6 months.
- Patients highly motivated for bariatric surgery.

EXCLUSION CITERIA

- Past history of any bariatric surgery intervention.
- Any hormonal reposition/block in the last 3 months.
- Testicular impairment.
- Phosphodiesterase type-5 inhibitor usage.
- Patients suffering from terminal illness unlikely to be improved with weight reduction, including advanced stage cancer and end-stage renal, hepatic and cardiopulmonary disease.
- Patients who were unable to understand the nature of bariatric surgery or the behavioral changes required afterwards, including untreated schizophrenia, active substance abuse, and noncompliance with previous medical care.
- Patients not consenting to participate in the study.
- Patients opting out of the study at any time during the study.

METHODS OF COLLECTION OF DATA

Particulars of each patient were duly noted including name, age, sex, occupation, admission number and address for future correspondence. A written informed consent was taken from all the patients. Surgery was performed according to patient's choice/subject to fitness. Detailed history of each patient was obtained including history of presenting symptoms, any pre-existing co-morbid conditions and the patient's past history including treatment and surgical history.

General Physical examination and thorough systemic examination was done upon all patients at the time of admission. All necessary routine investigations were done. Pre-operatively and post-operatively at 3 months and 6 months, all patients underwent specific weight and blood pressure measurements and laboratory investigations, as depicted in Table 8.

Table 8: Parameters Studied

	Before Surgery	**Post Op Day 1**	**3 Months Post Op**	**6 Months Post Op**
BMI				
FBS/HbA1c				
BP				
Lipid Profile				

Post Op Complications –

Pre-operative Evaluation

The evaluation was done by a dedicated bariatric team which included the bariatric surgeon, dietician, endocrinologist, gastroenterologist, psychiatrist, chest physician, anesthesiologist, and the cardiologist. The pre-operative preparation of the patient included:

I. Counselling

All patients were counselled regarding

- Management options available for obesity, including diet, exercise, pharmacotherapy, and surgery
- Expected weight loss

- Benefits in terms of sustained weight loss and resolution improvement of co-morbidities
- Risks of surgery including irreversibility of procedure
- General information regarding all surgical options
- Need for regular lifelong follow-up
- Strict compliance with the dietary, exercise and lifestyle medications advised before and after the surgery

II. Nutritional Counseling

- Preoperative and postoperative diet was planned in consultation with the dietician. The target weight was calculated in this session.

III. Detailed patient interview to include the following

- Patient's complete medical history including history of Diabetes Mellitus, Hypertension, Hypothyroidism and other co-morbidities along with details of treatment, duration and the dosages of medicines.
- History of sleep apnea and snoring, including, the requirement for assisted ventilation, home-based oxygen therapy.

All patients underwent a comprehensive multidisciplinary bariatric evaluation, which included:

- Cardiology Evaluation: ECG, Echocardiography and if required, Stress Thallium.
- Gastroenterology Evaluation: An upper gastrointestinal evaluation/endoscopy (UGIE) was done to rule out reflux esophagitis, hiatus hernia, and gastric ulcers.
- Evaluation by Pulmonary Physician included Pulmonary Function Tests and Arterial Blood Gas Analysis.
- Endocrinology Evaluation for detection, assessment and management of diabetes and hypothyroidism.
- Psychiatric Evaluation to rule out any serious psychiatric disorder.

Special tests were done, when indicated

- UGIE and Biopsy – Helicobacter Pylori
- Venous Doppler was done to rule a previous or existing DVT

Peri-operative Preparation

1. Patient comprehension was reviewed, and all patient queries were answered to their satisfaction. It was ensured that every patient undergoing bariatric surgery understood the following points:
    - Not all excess weight will be lost; only 50-75% EWL expected
    - Need for exercise after surgery
    - The importance of compliance with the dietary regimen (high protein, low sugar, low fat) after surgery
    - Need for lifelong follow-up
    - Need for lifelong supplementation with vitamins/minerals/protein
2. Regular Chest Physiotherapy with the incentive spirometer
3. Cardiology, Endocrinology, Medicine, Gastroenterology, Anesthesia, Dietician, and Psychiatry Re-evaluation
4. Perioperative Antibiotic Prophylaxis:
    - Inj. Cefuroxime 1.5 gm was given half an hour before surgery and then was continued 12 hourly for 24 hours
5. DVT Prophylaxis
    - Intermittent calf compression pumps was used intra-operatively and continued post-operatively till the patient was discharged
    - Inj. Clexane (or an alternative low molecular weight heparin) was used. The first dose was to be given 6 hours after surgery and continued post-operatively for 10 days.
    - The patient was mobilized early preferably on the day of surgery

Informed Consent

A detailed written informed consent was obtained. The patients were explained the purpose of the study. The proposed benefits and risks of the surgery were informed in detail to the patient. The patients were explained that their refusal to take part in the study would not affect their treatment in any way.

Diet Management

Pre-operative Period

Patient underwent a complete nutritional evaluation by a dietician. The patients were started on a low-calorie diet (LCD) during the first visit, around 1000-1400 kcal/day and were encouraged to do physical activity daily. Around two weeks before the surgery, the patient was shifted to a very low-calorie diet (800-1000 kcal/day). It is a liquid diet with meal replacement supplements. Diabetic patients were monitored closely as the requirement of oral hypoglycemic agents/insulin decreased during this period.

1 day before surgery, the patient was put on a clear liquid diet.

Post-operative

The patients were allowed orally on post-operative day 1. They were kept on a clear liquid diet for 1 day and then shifted to the liquid diet. They were gradually transferred to a pureed diet depending on the tolerance of liquid diet after 15 days to 1 month. “Pureed” means that all food has been ground or mashed to a consistency of a soft, smooth, thick paste similar to a pudding.

In the follow-up period, diet was modified according to the presence of any nutritional deficiency.

OPERATIVE TECHNIQUE

After visual assess to the intraperitoneal space using a 12 mm visi port trocar 18 cm below the left hypochondrium, the abdomen was insufflated to 15-20 mmHg. Then two 12 mm ports and two 5 mm ports were placed per abdomen, and a Nathanson liver retractor was inserted through a 5 mm skin incision in the sub-xiphoid location to retract the left lateral segment of liver. A mini gastric bypass creates a long narrow tube of the stomach along its right border (the lesser curvature). A loop of the small gut is brought up and hooked to this tube at about 180 cm from the start of the intestine.

OUTCOME

The outcome of the study was assessed by monitoring the following parameters:

1. Weight/BMI

2. Blood Pressure
3. Fasting Blood Glucose/HbA1c
4. Lipid Profile: Serum Triglyceride Level, High-Density Lipoprotein (HDL), Low-Density Lipoprotein (LDL), Very Low-Density Lipoprotein (VLDL)
5. Post-operative complications

STATISTICAL ANALYSIS

Data were described in terms of range; mean ± standard deviation (± SD), frequencies (number of cases) and relative frequencies (percentages) as appropriate. Comparison of quantitative variables between the groups was done using paired t-test . A probability value (*p* value) less than 0.05 was considered statistically significant. All statistical calculations were done using SPSS (Statistical Package for the Social Science) SPSS 21 version statistical program for Microsoft Windows.

OBSERVATIONS AND RESULTS

This study was conducted on 50 morbidly obese patients who were admitted to the Department of Surgery, DMC&H between January 2015 to December, 2018 and underwent Mini Gastric Bypass Surgery.

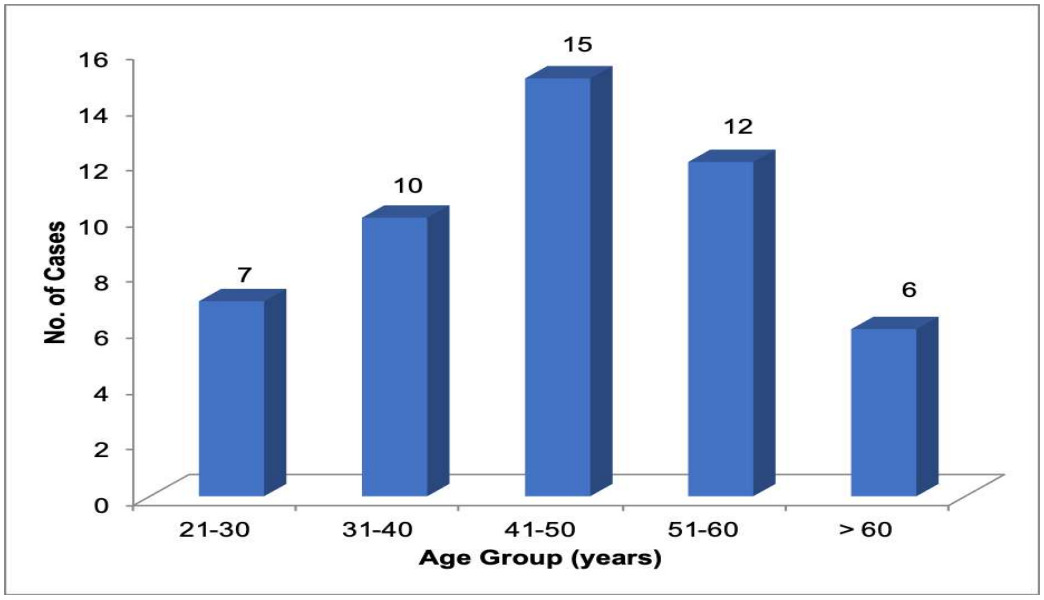
AGE

Minimum age of the patients was 26 years and maximum age was 76 years. Out of the 50 subjects enrolled in the study, 7 (14%) were in the age range of 21-30 years, 10 (20%) were 31-40 years, 15 (30%) were 41-50 years, 12 (24%) were 51-60 years and 6 (12%) were of the age more than 60 years as shown in the Table 9 and Figure 2. There was preponderance of age group 31-60 years (74%) in the study. Mean age of the patients was 46.7 ± 12.4 years.

Table 9: Age Wise Distribution of Patients

Age group (Years)	No. of Subjects	Percentage
21-30	7	14.0%
31-40	10	20.0%
41-50	15	30.0%
51-60	12	24.0%
> 60	6	12.0%
Total	50	100.0%

Figure 2: Age Wise Distribution of Patients



GENDER

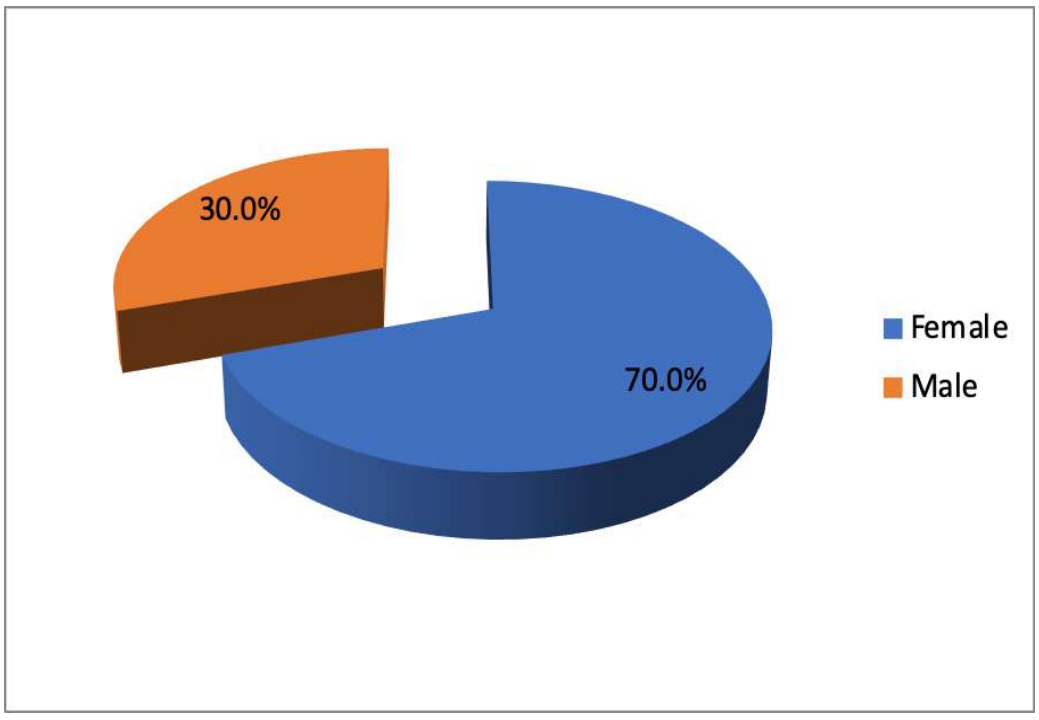
Of the 50 subjects studied, 15 (30%) were male and 35 (70%) were female as shown in Table 10 and Figure 3.

There was preponderance of female population in the study with maximum females in the age range of 31-60 years.

Table 10: Gender Wise Distribution of Patients

Gender	No. of Cases	Percentage
Female	35	70.0%
Male	15	30.0%
Total	50	100.0%

Figure 3: Gender Wise Distribution of Patients



WEIGHT AND HEIGHT

Mean height of the patients included in the study was 1.67 ± 0.05 m. Mean Ideal weight was calculated and found out to be 64.02 ± 3.93 kg as shown in Table 11.

Table 11: Mean Standard Height and Ideal Weight

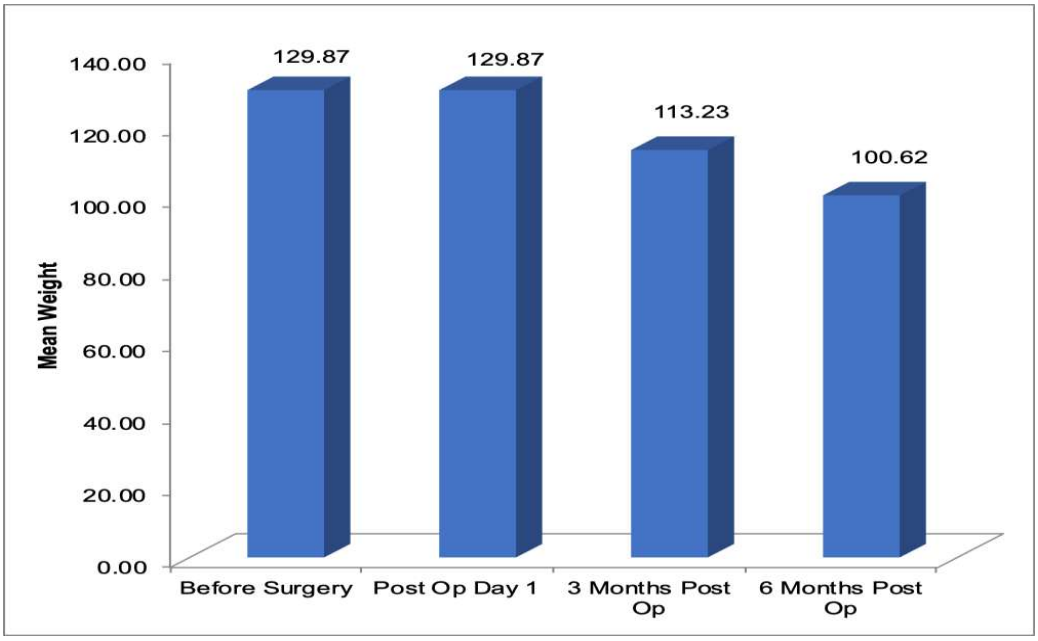
	Mean
Height (m)	1.67 ± 0.05
Ideal weight	64.02 ± 3.93

Significant reduction in the mean weight was noted in all the patients after surgery. There was marked fall in the mean weight from 129.87 ± 20.43 kg to 113.23 ± 16.03 kg after three months and 100.62 ± 14.11 kg after six months of undergoing the mini gastric bypass surgery as shown in the Table 12 and Figure 4.

Table 12: Changes in Weight

WEIGHT (Kg)	Mean
Before Surgery	129.87 ± 20.43
Post Op Day 1	129.87 ± 20.43
3 Months Post Op	113.23 ± 16.03
6 Months Post Op	100.62 ± 14.11

Figure 4: Comparison of Pre & Post Operative Weight of Patients

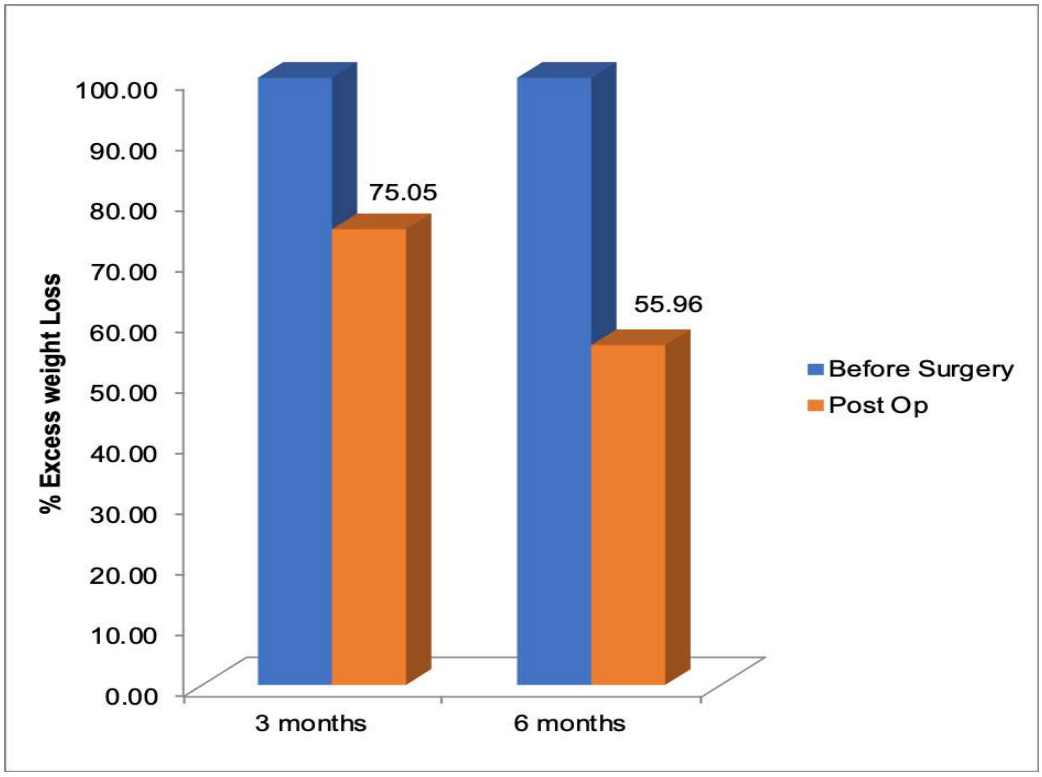


Mean % Excess Weight Loss after three months of undergoing the procedure was 24.95 ± 9.35 % and 44.04 ± 13.42 % after six months of undergoing the mini gastric bypass procedure as shown in Table 13. After three months of surgery, patient's weight reduced to 75% of the preoperative weight and after six months, the weight reduced to 56% of the preoperative weight as shown in Figure 5.

Table 13: Mean % Excess Weight Loss

	Mean % Excess Weight Loss
3 Months Post Op	24.95 ± 9.35
6 Months Post Op	44.04 ± 13.42

Figure 5: Comparison of Mean % Excess Weight Loss at 3 and 6 months Post Op



BODY MASS INDEX

BMI (Body Mass Index) is calculated by weight (in kg) divided by height (in m^2). This is the main parameter depending upon which patient becomes eligible for bariatric surgery.

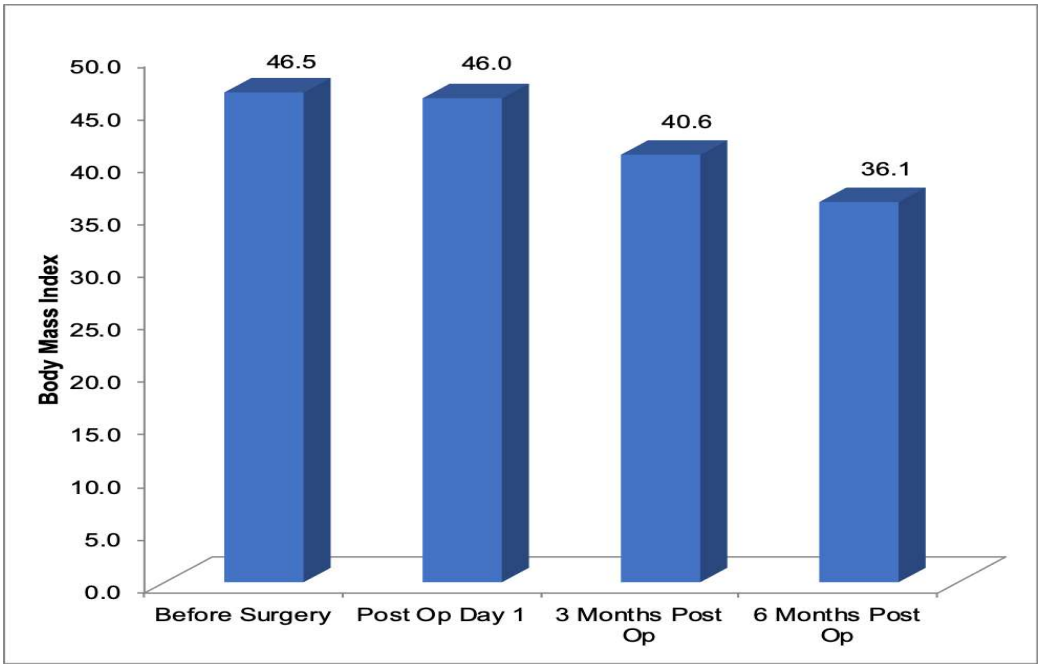
Of the 50 patients studied, significant fall (p= 0.000) in the mean BMI was noted, from 46.5 ± 5.9 kg/m^2 pre-operatively to 40.6 ± 4.7 kg/m^2 and 36.1 ± 4.4 kg/m^2, three months and six months respectively after undergoing the procedure as shown in the Table 14 and Figure 6. This shows that Laparoscopic Mini Gastric Bypass resulted in improvement in the weight of morbidly obese patients following the procedure.

Table 14: Changes in Body Mass Index

BMI (kg/m^2)	Mean
Before Surgery	46.5 ± 5.9
Post Op Day 1	46.0 ± 5.8
3 Months Post Op	40.6 ± 4.7
6 Months Post Op	36.1 ± 4.4

p-value – 0.000

Figure 6: Comparison of Pre & Post Operative Body Mass Index of Patients



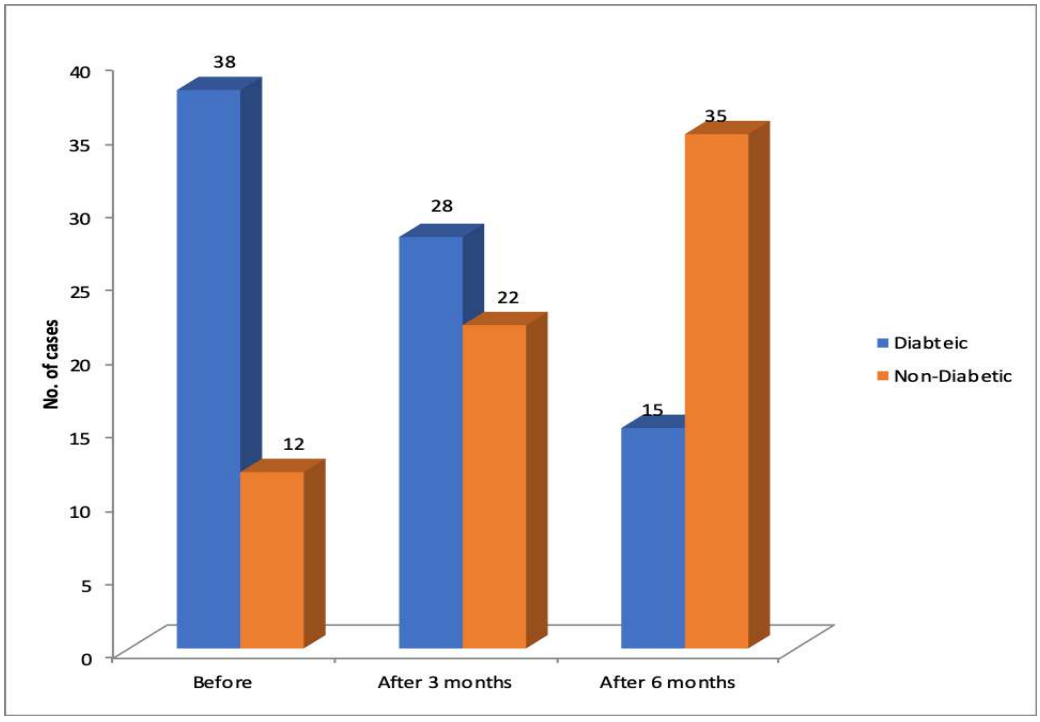
TYPE 2 DIABETES MELLITUS

38 of the 50 patients studied had Type 2 Diabetes Mellitus pre-operatively, out of which only 14 remained diabetic after six months of undergoing the Mini Gastric Bypass. These 14 patients had significant fall in their Mean Fasting Blood Sugar levels (p=0.000) and Mean HbA1c values (p=0.000). The number of patients who had improvement in their diabetic status was 12 after three months of surgery which increased to 24 at six months after surgery as shown in Table 15 and Figure 7. LMGB resulted in the reduction of diabetics from 76% to 56% at three months and 24% at six months after surgery.

Table 15: Diabetic Status of Patients

	Before		After 3 months		After 6 months	
Diabetics	No. of cases	%	No. of cases	%	No. of cases	%
Diabetic	38	76.0%	28	56.0%	14	28.0%
Non-Diabetic	12	24.0%	22	44.0%	36	72.0%

Figure 7: Comparison of Pre & Post Operative Diabetic Status of Patients



Fasting Blood Sugar

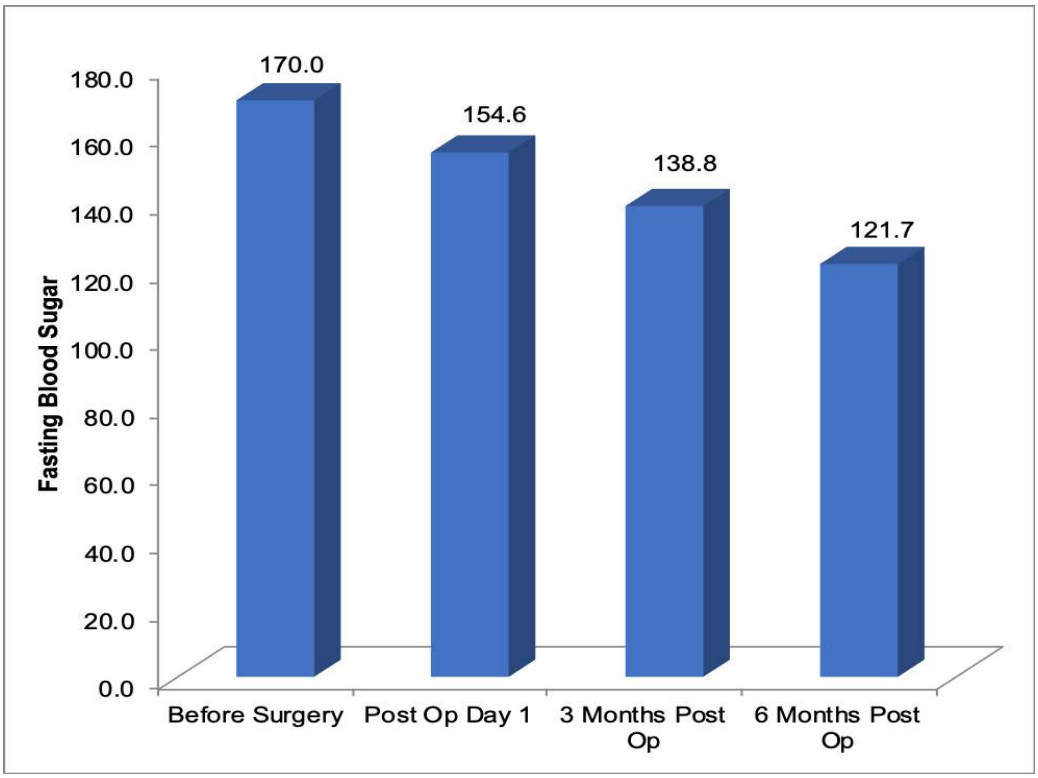
Mean Fasting Blood Sugar levels fell significantly in all the patients in our study. Marked fall in the mean FBS levels were seen from 170.0 ± 42.4 mg/dl preoperatively to 138.8 ± 24.8 mg/dl and 121.7 ± 17.9 mg/dl at three and six months respectively after undergoing LMGB as shown in Table 16 and Figure 8.

Table 16: Changes in Fasting Blood Sugar Levels

FBS (mg/dL)	Mean
Before Surgery	170.0 ± 42.4
Post Op Day 1	154.6 ± 34.6
3 Months Post Op	138.8 ± 24.8
6 Months Post Op	121.7 ± 17.9

p-value – 0.000

Figure 8: Comparison of Pre & Post Operative Fasting Blood Sugar Levels



HbA1c

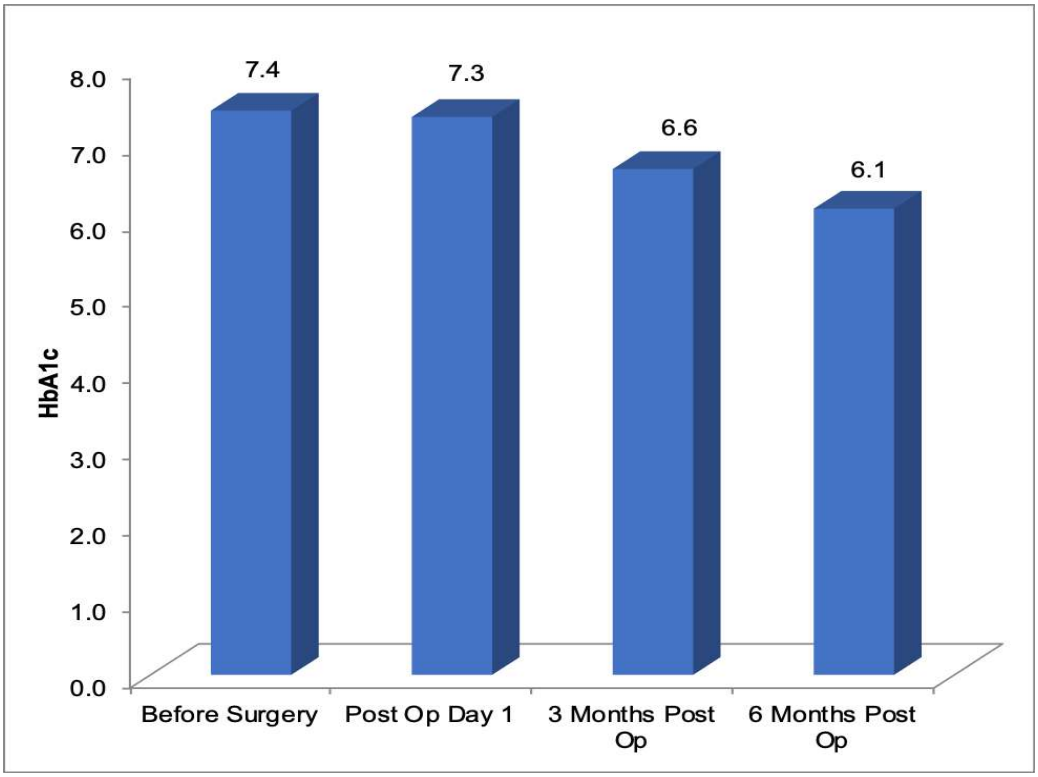
There was significant reduction in the values of HbA1c seen in our study. Mean HbA1c levels fell from 7.4 ± 1.4 preoperatively to 6.6 ± 1.0 and 6.1 ± 0.7 at three and six months respectively after undergoing LMGB as shown in Table 17 and Figure 9. The surgery resulted in long term control of blood glucose levels in the patients.

Table 17: Changes in HbA1c Levels

HbA1c	Mean
Before Surgery	7.4 ± 1.4
Post Op Day 1	7.3 ± 1.4
3 Months Post Op	6.6 ± 1.0
6 Months Post Op	6.1 ± 0.7

p-value – 0.000

Figure 9: Comparison of Pre & Post Operative HbA1c Levels



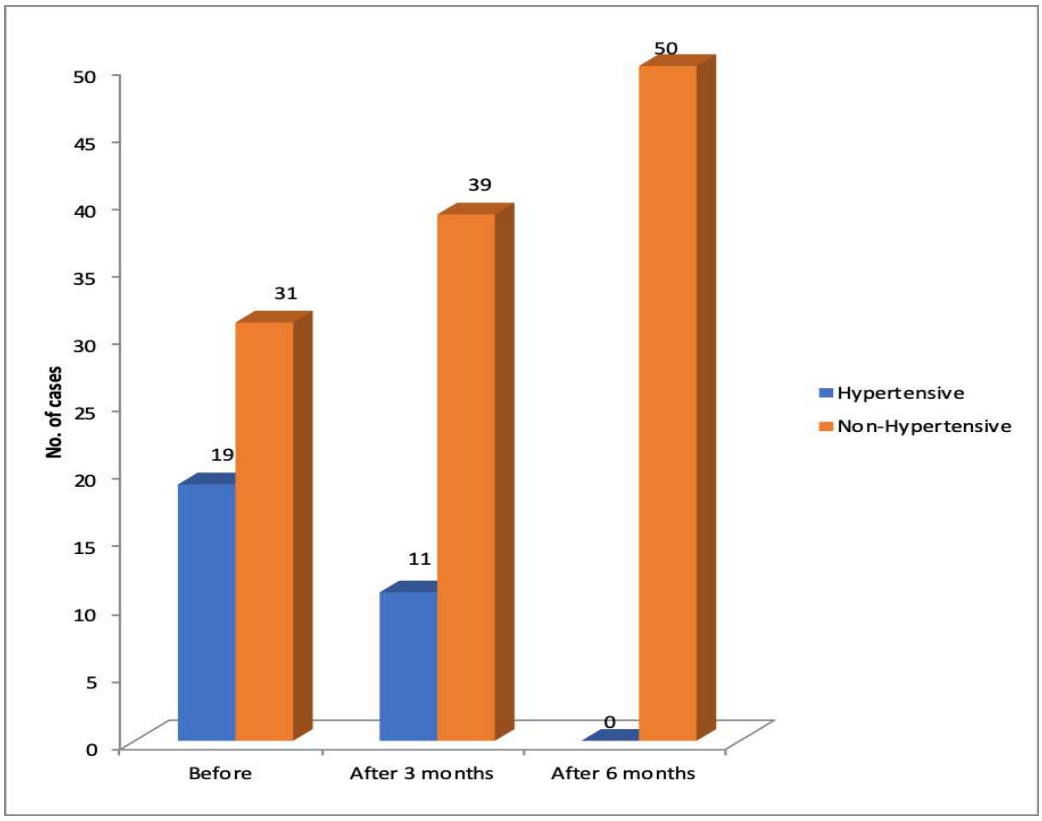
HYPERTENSION

Of the 50 patients studied, the number of patients who had hypertension pre-operatively was 19, which reduced to 11 at three months after surgery and 0 at six months after undergoing Laparoscopic Mini Gastric Bypass as shown in Table 18 and Figure 10.

Table 18: Hypertensive Status of Patients

	Before		After 3 months		After 6 months	
Hypertension	No. of cases	%	No. of cases	%	No. of cases	%
Hypertensive	19	38.0%	11	22.0%	0	0.0%
Non-Hypertensive	31	62.0%	39	78.0%	50	100.0%

Figure 10: Comparison of Pre & Post Operative Hypertensive Status of Patients



SYSTOLIC BLOOD PRESSURE

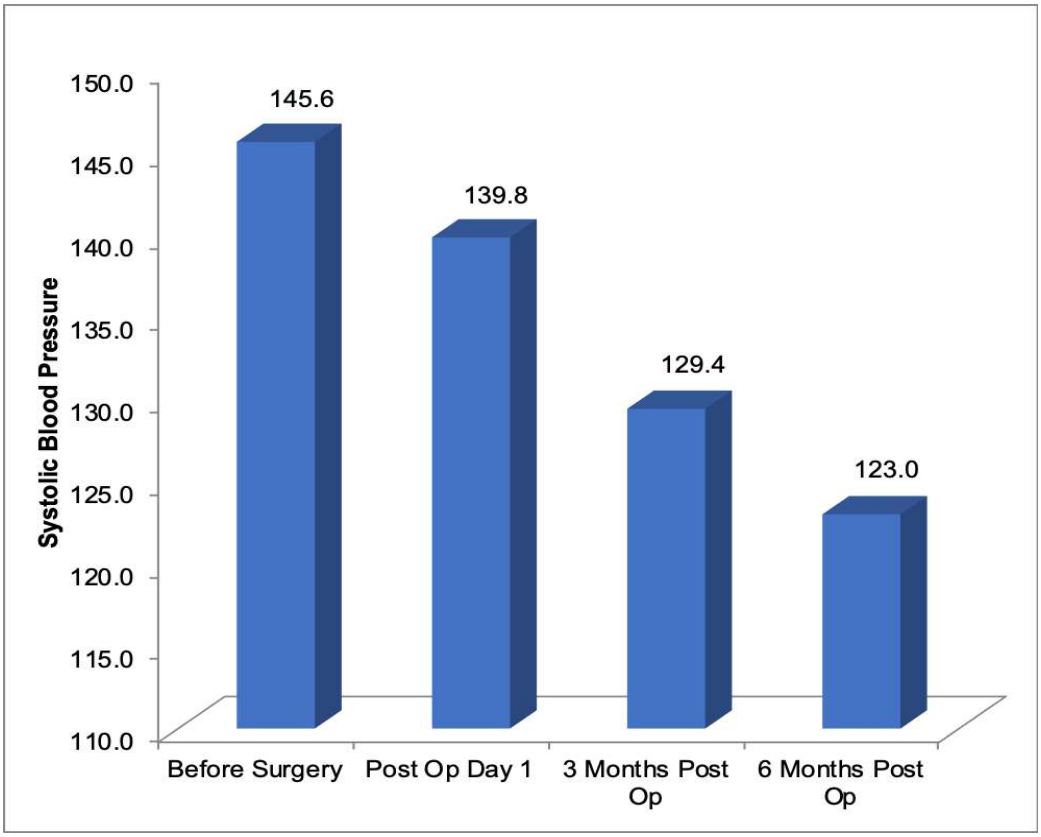
There was significant fall in the Mean Systolic Blood Pressure readings from 145.6 ± 12.6 mmHg preoperatively to 129.4 ± 7.4 mmHg and 123.0 ± 8.1 mmHg after three and six months of undergoing Laparoscopic Mini Gastric Bypass as shown in Table 19 and Figure 11.

Table 19: Changes in Systolic Blood Pressure Readings

SBP (mmHg)	Mean
Before Surgery	145.6 ± 12.6
Post Op Day 1	139.8 ± 10.4
3 Months Post Op	129.4 ± 7.4
6 Months Post Op	123.0 ± 8.1

p-value – 0.000

Figure 11: Comparison of Pre & Post Operative Systolic Blood Pressure Readings



DIASTOLIC BLOOD PRESSURE

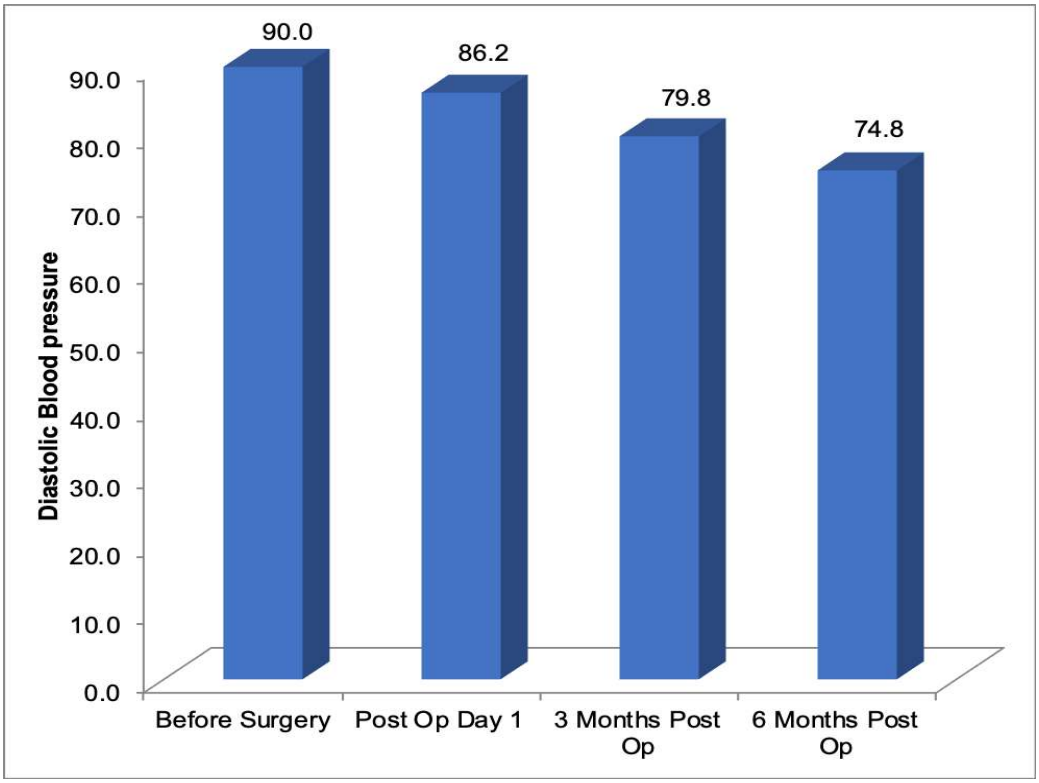
There was significant fall (p=0.000) in the Mean Diastolic Blood Pressure fell from 90.0 ± 6.4 mmHg pre-operatively to 79.8 ± 7.1 mmHg and 74.8 ± 6.1 mmHg at three and six months respectively after undergoing Laparoscopic Mini Gastric Bypass as shown in Table 20 and Figure 12.

Table 20: Changes in Diastolic Blood Pressure Readings

DBP (mmHg)	Mean
Before Surgery	90.0 ± 6.4
Post Op Day 1	86.2 ± 6.7
3 Months Post Op	79.8 ± 7.1
6 Months Post Op	74.8 ± 6.1

p-value – 0.000

Figure 12: Comparison of Pre & Post Operative Diastolic Blood Pressure Readings



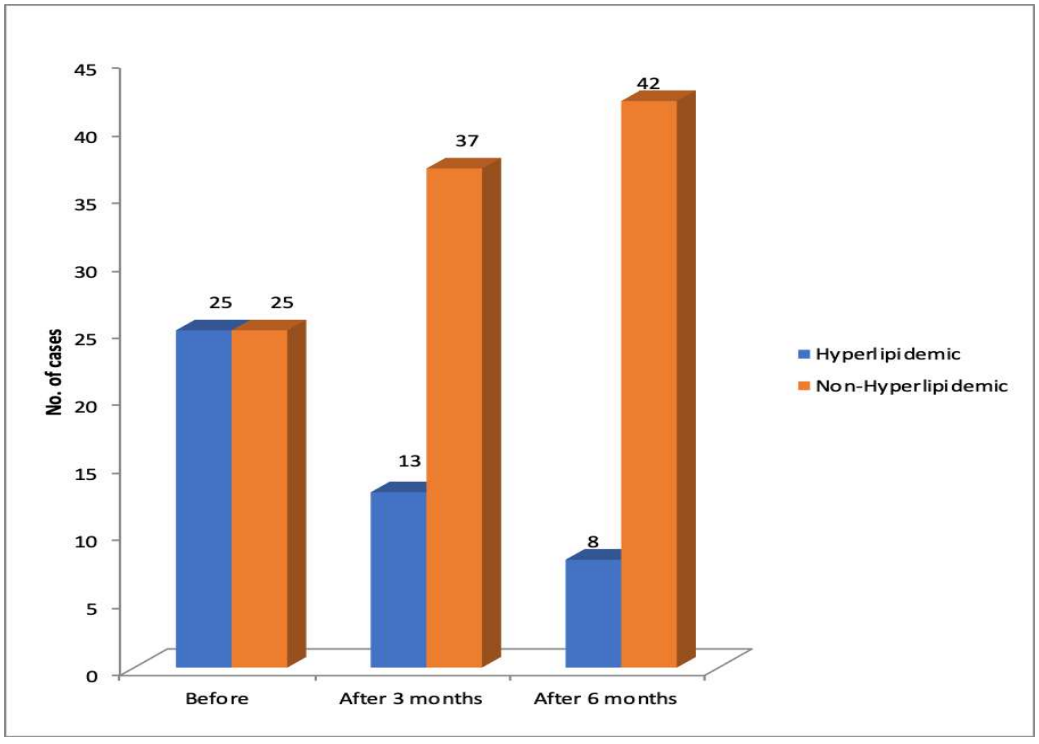
HYPERLIPIDEMIA

25 of the 50 patients enrolled in the study were hyperlipidaemic. The number of patients who had hyperlipidemia reduced to 13 at three months after surgery and 11 at six months of undergoing surgery as shown in Table 21 and Figure 13, and fourteen had significant fall in their respective parameters. 28% of the 50% patients who were hyperlipidaemic at the start of the study had improvement in their lipid profile and the remaining 22% had significant reduction in their mean Triglyceride, LDL and VLDL levels and rise in their mean HDL levels.

Table 21: Hyperlipidemic Status of Patients

Hyperlipidemia	Before		After 3 months		After 6 months	
	No. of Cases	%	No. of Cases	%	No. of Cases	%
Hyperlipidemic	25	50.0%	13	26.0%	11	22.0%
Non-Hyperlipidemic	25	50.0%	37	74.0%	39	78.0%

Figure 13: Comparison of Pre & Post Operative Hyperlipidemic Status of Patients



TRIGLYCERIDE

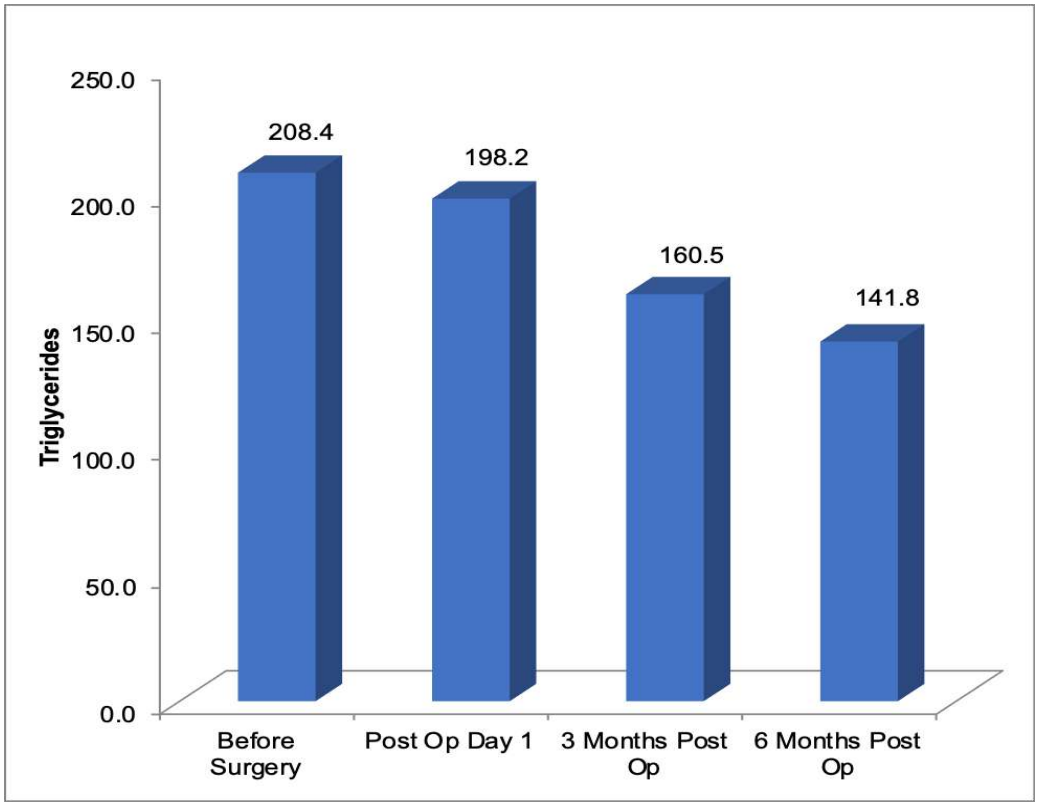
Significant fall (p=0.000) in the mean Triglyceride levels fell from 208.4 ± 87.5 mg/dL preoperatively to 160.5 ± 40.9 mg/dL and 141.8 ± 29.6 mg/dL at three and six months postoperatively as shown in Table 22 and Figure 14.

Table 22: Changes in Triglyceride Levels

TRIGLYCERIDES (mg/dL)	Mean
Before Surgery	208.4 ± 87.5
Post Op Day 1	198.2 ± 78.1
3 Months Post Op	160.5 ± 40.9
6 Months Post Op	141.8 ± 29.6

p-value – 0.000

Figure 14: Comparison of Pre & Post Operative Triglyceride Levels



HIGH DENSITY LIPOPROTEINS

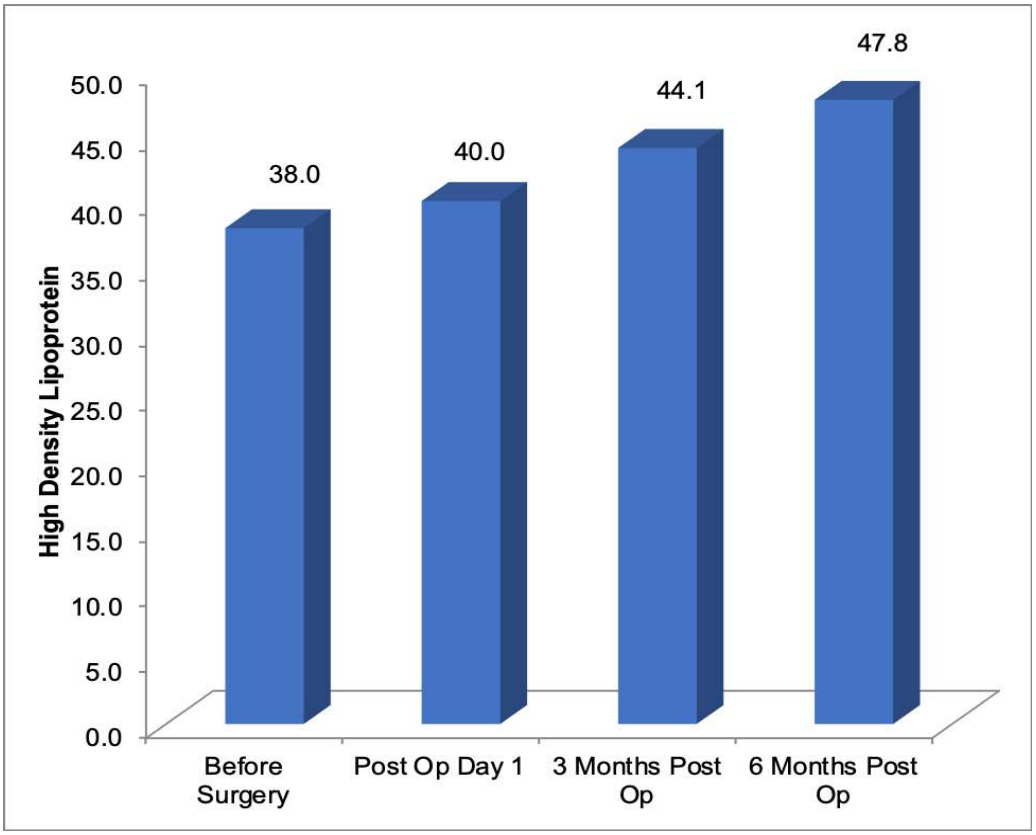
There was significant rise (p=0.000) in the level of High Density Lipoproteins from 38.0 ± 4.4 mg/dL preoperatively to 44.1 ± 3.3 mg/dL and 47.8 ± 2.6 mg/dL at three and six months after undergoing Laparoscopic Mini Gastric Bypass as shown in Table 23 and Figure 15.

Table 23: Changes in High Density Lipoprotein Levels

HDL (mg/dL)	Mean
Before Surgery	38.0 ± 4.4
Post Op Day 1	40.0 ± 4.2
3 Months Post Op	44.1 ± 3.3
6 Months Post Op	47.8 ± 2.6

p-value – 0.000

Figure 15: Comparison of Pre & Post Operative High Density Lipoprotein Levels



LOW DENSITY LIPOPROTEINS

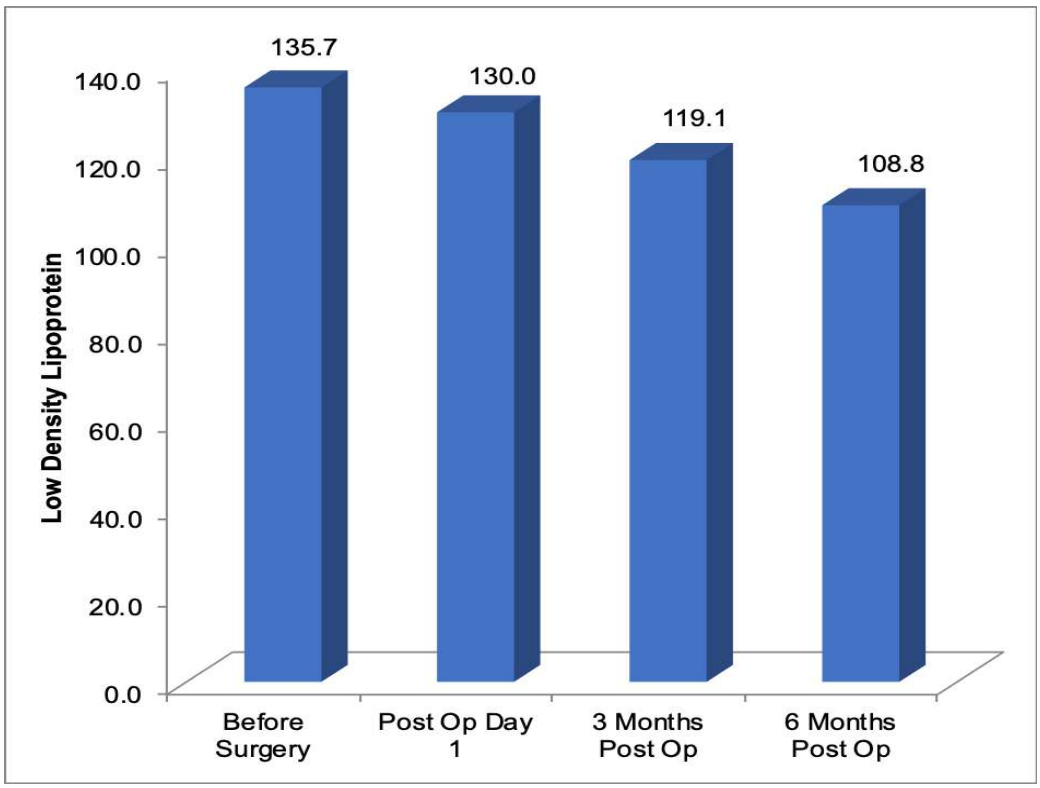
There was significant fall (p=0.000) in the level of Low Density Lipoproteins from 135.7 ± 24.5 mg/dL preoperatively to 119.1 ± 17.7 mg/dL and 108.8 ± 16.5 mg/dL at three and six months respectively after undergoing Laparoscopic Mini Gastric Bypass as shown in Table 24 and Figure 16.

Table 24: Changes in Low Density Lipoprotein Levels

LDL (mg/dL)	Mean
Before Surgery	135.7 ± 24.5
Post Op Day 1	130.0 ± 22.4
3 Months Post Op	119.1 ± 17.7
6 Months Post Op	108.8 ± 16.5

p-value - 0.000

Figure 16: Comparison of Pre & Post Operative Low Density Lipoprotein Levels



VERY LOW DENSITY LIPOPROTEINS

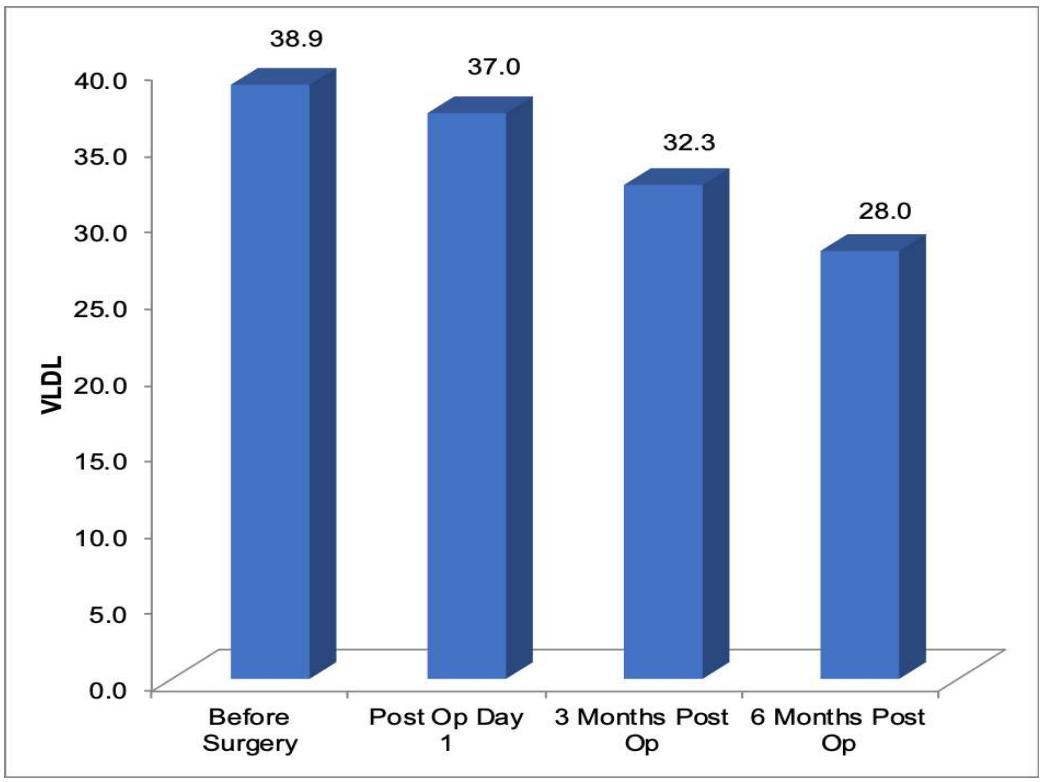
Significant reduction (p=0.000) was observed in the levels of Very low Density Lipoproteins which fell from 38.9 ± 9.9 mg/dL preoperatively to 32.3 ± 8.4 mg/dL and 28.0 ± 7.3mg/dL at three and six months after undergoing Laparoscopic Mini Gastric Bypass as shown in Table 26 and Figure 17.

Table 25: Changes in Very Low Density Lipoprotein Levels

VLDL (mg/dL)	Mean
Before Surgery	38.9 ± 9.9
Post Op Day 1	37.0 ± 9.3
3 Months Post Op	32.3 ± 8.4
6 Months Post Op	28.0 ± 7.3

p-value – 0.000

Figure 17: Comparison of Pre & Post Operative Very Low Density Lipoprotein Levels



POST OPERATIVE COMPLICATIONS

There were no major post-operative complications noted in any patients until six months after undergoing the Mini Gastric Bypass Surgery. Diarrhoea was noted in 7 patients, and bile reflux in 2 patients which was managed conservatively with PPIs and prokinetics. 3 patients had a marginal ulcer which occurred at the GEJ, and all three responded to conservative management with PPI, yoghurt, and cessation of cigarettes, NSAIDs and alcohol. Nausea and GERD was seen in 9 patients and managed conservatively. All the symptoms were managed without the need of any operative intervention.

Table 26: Post Operative Complications

Post Operative Complications	Incidence
Diarrhoea	7
Bile Reflux	2
Marginal Ulcer	3
Nausea	9
GERD	9

DISCUSSION

The incidence of metabolic syndrome is increasing at an accelerating and alarming rate worldwide and is considered as a major public-health concern.[45] Although medical management of morbid obesity patients made some progress, however, a persistent weight reduction can hardly be achieved in these patients. For extreme cases of obesity, only surgical intervention can produce substantial weight loss. Surgery is only one part of a long term multidisciplinary approach that should include a plan for lifelong follow up including monitoring for nutritional and metabolic complications and dietary counselling to prevent weight gain.[46]

Our study was conducted in Dayanand Medical College & Hospital, Ludhiana in which 15 male and 35 female morbidly obese patients were enrolled after applying the inclusion and exclusion criteria. Weight, Height and Body Mass Index of patients was noted pre-operatively and after 1 day, 3 months and 6 months of surgery. Diabetic and Hypertensive status i.e. Fasting Blood Sugar, HbA1c and Blood Pressure of the patients was monitored carefully and values documented at each visit. Similarly, Lipid Profile and post-operative complications were evaluated pre-operatively and after 1 day, 3 months and 6 months of surgery and documented.

DECREASE IN WEIGHT AND BMI FOLLOWING LMGB

Success or failure of any weight reducing technique is measured by extent of reduction in weight and body mass index which is an important parameter of a study. In our study, significant reduction in the mean weight was noted in all the patients after surgery. There was marked fall in the mean weight from 129.87 $\pm$ 20.43 kg to 113.23 $\pm$ 16.03 kg after three months and 100.62 $\pm$ 14.11 kg after six months of undergoing the mini gastric bypass surgery.

Mean % Excess Weight Loss after three months of undergoing the procedure was 24.95 $\pm$ 9.35 % and 44.04 $\pm$ 13.42 % after six months of undergoing the mini gastric bypass procedure. After three months of surgery, patient's weight reduced to 75% of the preoperative weight

and after six months, the weight reduced to 56% of the preoperative weight.

Mean fall in BMI after 3 months and 6 months of surgery was 5.9 kg/m^2 and 10.4 kg/m^2. Of the 50 patients, 22 patients had BMI fall below the cut off level of 35 kg/m^2 for morbid obesity after 6 months of undergoing surgery. There was a significant fall in BMI at 3 months and 6 months following LMGB in our study group with mean BMI at 3 months and 6 months after surgery being 40.6 kg/m^2 and 36.1 kg/m^2 as compared to the pre-op values of 46.5 kg/m^2. Table 27 shows changes in BMI in other studies compared to our study.

A study conducted by Abdallah et al[29] demonstrated significant reduction in the BMI whereby the mean initial BMI for the patients was 47.33 kg/m^2. After 6 months BMI decreased to 38.35 kg/m^2. After 1 year BMI decreased to 33.70 kg/m^2.

An important reason for reduction in BMI in LMGB is due to the functional restriction, its effect on absorption and change in dietary behaviour. The non-obstructed pouch allows slight restriction but adequate oral intake, accompanied by fat/carbohydrate malabsorption. Because the patient avoids carbohydrate which could produce rapid dumping, the intake has mainly fat malabsorption. The pouch in the MGB develops minimal dilatation, because there is no outlet narrowing by a stoma or pylorus. There is slight increase in the number of stools per day (generally from 1 to 2).[47]

Table 27: BMI in our study and other studies

Studies	No. of cases	Duration of follow up	Initial BMI (kg/m^2)	BMI after one year (kg/m^2)
Carbajo et al.	209	One year	48	30.02
Noun et al.	1000	One year	42.5	28.3
Musella et al.	974	One year	48	31.8
Wang et al.	423	One year	44.2	29.2
Piazza et al.	197	One year	52.9	39.4
Abdallah et al.	100	One year	47.33	33.07
Our Study	50	6 months	46.5	36.1

EFFECT ON CO-MORBIDITIES – T2DM, HYPERTENSION, DYSLIPIDEMIA

Regarding controlling of co-morbidities in our study; T2DM resolved in 68%, HTN resolved in 100% and Dyslipidemia got treated in 56% of patients after 6 months. Similar results were observed in the study conducted by Abdallah et al[29] which revealed control of co-morbidities whereby DM resolved in 82%, HTN resolved in 90% and Dyslipidemia got treated in 80% of patients after 1 year. Table 28 shows changes in other studies.

Table 28: Improvement in T2DM, HTN and Dyslipidemia in our study & other studies

Studies	DM (%)	HTN (%)	Dyslipidemia (%)
Rutledge and Walsh	83	80	80
Wang et al.	100	94	85
Noun et al.	85	85	82
Abdallah et al	82	90	80
Our Study	68	100	56

EFFECT ON GLYCOSYLATED Hb

The remission rate from T2DM is defined by the American Diabetes Association as glycated haemoglobin (HbA1c) <6.5% without any medication. LMGB has been shown to reduce co-morbidities and mortality in patients with morbid obesity and most significantly to ameliorate or resolve Type-2 Diabetes mellitus. Much of the improvement has been related to the weight loss after surgery. However, some effects appear to be independent from weight loss.

In our study, there was significant reduction in levels glycosylated haemoglobin at 3 months and 6 months post-operatively in diabetic patients with mean HbA1c at 3 months and 6 months being 6.6 $\pm$ 1.0 and 6.1 $\pm$ 0.7 respectively as compared to the mean pre-operative value of 7.4 $\pm$ 1.4.

Musella[9] reported a multicentre experience in Italy showing a T2D remission rate of 85%, which was Table with time at 12, 36 and 60 months after surgery as shown in Table 29.

A recent European survey[48] compared the efficacy of MGB and sleeve gastrectomy (SG) in T2D at 1 year of follow-up. A significant BMI decrease and T2D resolution unrelated to weight loss were recorded for both procedures. On univariate and multivariate analyses, MGB appears to outperform significantly SG. Four independent variables able to influence T2D remission at 12 months have been identified. Three were negative predictors: high baseline HbA1c, pre-operative consumption of insulin or oral antidiabetic agents, or T2D duration >10 years. MGB was a positive predictor of diabetes remission.

Table 29: Follow Up Outcome[9]

	12 months n (%)	**36 months n (%)**	**60 months n (%)**
Patients in follow-up/ Patients eligible for follow-up	795/838 (94.8%)	510/570 (89.4%)	201/254 (79.1%)
Weight	91.5 ± 18.5	79.1 ± 8.55	81.7 ± 23.15
BMI (kg/m2)	31.88 ± 4.91	27.5 ± 2.12	28 ± 2.25
EWL (%)	70.12 ± 8.35	81.5 ± 4.95	77 ± 5.14
Diabetics in remission/ Total Diabetics in follow up	175/201 (87)	160/186 (86)	87/103 (84.4)
Hypertensives Treated/ Total Hypertensives in follow up	172/190 (90.5)	132/155 (85.1)	84/96 (87.5)

The achievement of normoglycemia after bariatric procedures results from multiple changes that occur post-operatively such a dietary control, decreased plasma ghrelin levels, which in turn leads to increase in maximal capacity of glucose induced insulin release by the islets cells. Other causes of normoglycemia include weight loss, reduction of body fat and the release of gastrointestinal hormones that interfere with the function of pancreatic beta-cells (incretins).

EFFECT ON BLOOD PRESSURE

Hypertension seems to be one of the co-morbidities which is the most difficult to improve. In our study, there was significant improvement in the blood pressure readings of patients at 6 months after surgery whereby all the 19 hypertensive patients had resolution of the disease at 6 months post-operatively. There was marked reduction in systolic blood pressure readings from 145.6 ± 12.6 mmHg pre-operatively to 129.4 ± 7.4 mmHg and 123.0 ± 8.1 mmHg at 3 months and 6 months post-operatively respectively with mean diastolic blood pressure at 3 months and 6 months after surgery being 79.8 ± 7.1mmHg and 74.8 ± 6.1 mmHg respectively as compared to the mean pre-operative value of 90.0 ± 6.4 mmHg.

Similar results were obtained in the study carried out by Chevallier et al[49] where the rate of hypertension decreased from 38 to 18.5% at 5 years. Kular[50] reported 76% remission which was equivalent to the 74% after SG (Table 28). The results on hypertension in Italy are even better because the resolution remained stable around 85–90% at 1, 3 and 5 years (Table 29).

Hypertension is reduced due to weight reduction with less total body mass to which blood needs to reach, reduced insulin resistance, reduced fat cells lining the endothelium of blood vessels, increased pliability of the vessel wall (vascular compliance due to reduced sympathetic tone), and increased mobility or exercise improving cardiac reserve and stroke volume. Reduction of weight and normalisation of BMI helps maintain normal thyroid function as obesity and metabolic factors play an important role especially in hypothyroid obese patients.

EFFECT ON LIPID PROFILE

Dyslipidaemia is a recognised cardiovascular risk factor in obese patients. In our study, there was a significant decrease in S. Cholesterol and S. Triglyceride levels at 3 months and with a significant improvement (p=0.000) in HDL levels. LDL and VLDL levels also showed a statistically significant (p=0.000) decrease. 14 out of the 25

dyslipidaemic patients achieved normal values of S. Triglycerides, S. LDL, S. VLDL within 6 months of surgery and thus showed a resolution of dyslipidaemia.

Similar results were found in a study conducted by Chevalier et al[49], at 2 years, the resolution rate for dyslipidaemia was 80.6%. After 5 years, the rate of hyperlipemia decreased from 25 to 5% (Table 30). In India, hyperlipemia resolution rate at 5 years was 90% after MGB and 72% after SG (Table 31).

Table 30: Evolution of Co-morbidities at 5 years[49]

	Before MGB/OAGB n = 126	**60 months after MGB n = 126**	**p-value**
Hypertension	48 (38%)	23 (18.5%)	<0.001
Hyperlipemia	31 (25%)	6 (5%)	<0.001
Joint pain	52 (41%)	33 (26.5)	0.014
T2DM	28 (22%)	5 (4%)	<0.001
Sleep Apnoea	24 (19.5%)	12 (9.5%)	0.029

Table 31: Improvement in Co-morbidities, comparing MGB to Sleeve Gastrectomy

	MGB		**LSG**	
	Preop Comorbidity (%)	**Remission (%)**	**Preop Comorbidity (%)**	**Remission (%)**
T2DM	63 (60.4%)	92	61 (24%)	81
Hypertension	66 (58.3%)	76	56 (47.3%)	74
Hyperlipemia	65 (62.2%)	90	64 (54.3%)	72
Sleep Apnoea	28 (26.8%)	97	26 (22.2%)	86
GERD	5 (4.9%)	72	6 (5.5%)	33

Comparison of MGB with RYGB

When comparing MGB to RYGB[51], a follow-up study disclosed an improvement of obesity-related clinical parameters in both groups without significant difference at 5 years after surgery (Table 32). The resolution rate of metabolic syndrome was >80% for both groups. Both groups had a significant decrease of haemoglobin (Hb) level after bypass surgery, but MGB patients had a lower level of Hb and mean corpuscular volume (MCV) than RYGB patients.

Table 32: Comparison of clinical characteristics of patients 5 years after laparoscopic Roux-en-Y (RYGB) vs Mini-Gastric Bypass (MGB)[51]

	RYGB (n = 71)	MGB (n = 277)	p-value
BMI (kg/m^2)	29.2 ± 5.3	27.7 ± 5.8	0.041*
Excess Weight Loss (%)	60.1 ± 20.4	72.9 ± 19.3	0.040*
Metabolic Syndrome n (%)	10 (14.1)	15 (5.4)	0.012*
Albumin (G/Dl)	4.5 ± 0.3	4.4 ± 0.4	0.680
WBC (103/Ml)	6.1 ± 0.8	5.9 ± 2.3	0.949
Haemoglobin (G/Dl)	12.5 ± 1.4	10.1 ± 2.8	0.006*
MCV (Fl)	85.3 ± 5.5	74.9 ± 13.5	0.019*

*$p < 0.05$

Comparison of MGB with RYGB and LSG

In a series conducted by Jammu et al[52], the % EWL was maximal after MGB, followed by RYGB and LSG—92.2%, 72.3% and 53.6% respectively (significant at $p < 0.05$). For resolution of co-morbidities, dyslipidaemia, hypertension and T2D were considered (Table 33). After SG, 55.8% of patients were rid of their elevated lipid levels, after RYGB 75.0% of patients had normal lipid levels, and after MGB 93.4% of dyslipidaemia was cured. With pre-existing hypertension, again MGB resolved the most cases. In resolution of T2D, MGB showed spectacular results—94.4% of patients stopped their regular T2D medications a few weeks after MGB, while after RYGB, 76.2% and after LSG, 59.4% of diabetic patients had resolution of T2D. This result was significant ($p < 0.05$).

Table 33: Resolution of Co-Morbidities by Operation[52]

Cases	LSG	RYGB	MGB
Total No. of T2D Patients	23	33	62
No. of Patients Achieving Remission	13	25	59
Percentage	56.5%	75.8%	95.1%
Total No. of Hypertensive Patients	30	47	48
No. of Patients Achieving Remission	14	34	41
Percentage	46.7%	72.3%	85.4%
Total No. of Patients With Dyslipidemia	21	50	45
No. of Patients Achieving Remission	11	37	42
Percentage	52.4%	74.0%	93.3%
Only Obese (Without Co-Morbidities)	23	13	12
No. of Patients Achieving Remission	14	7	12
Percentage	60.9%	53.8%	100.0%

Being a one time procedure, patient compliance is better, and the maintenance cost is low. LMGB is thus considered the most effective weight loss therapy available for patients with morbid obesity. Bariatric surgery results in marked and long-lasting weight loss and elimination or improvement of most obesity-related complications, including diabetes, hypertension, hyperlipidaemia, obstructive sleep apnoea, gastro-oesophageal reflux disease, cardiac dysfunction, osteoarthritis, low back pain and eating disorders.

At present, the preoperative factors predicting the successful treatment of metabolic syndrome after LMGB have not yet been established. Possible factors associated are old age, male gender, diabetes duration > 10 years, use of insulin and the severity of preoperative B cell dysfunction.

SUMMARY & CONCLUSION

The present study was done in the Department of Surgery, Dayanand Medical College & Hospital, Ludhiana. It included 50 Morbidly Obese patients (BMI > 35kg/m^2) who underwent Laparoscopic Mini Gastric Bypass Surgery. Most of the cases in the study were females (70%) and were in the age group of 41-60 years (54%). Of the total 50 morbidly obese patients, 20 had BMI <35 kg/m^2 at 6 months after surgery and 30 having significant fall in BMI without any major post-operative complications.

Of the 38 diabetic patients, 14 had significant improvement in their HbA1c levels with 24 having HbA1c in the normal range after 6 months of undergoing the procedure. Of the 19 hypertensive patients, all had their blood pressure in the normal range six months after the surgery. Of the 25 hyperlipidaemic patients, 14 had lipid levels in the normal range after six months of the procedure and 11 had significant fall in their Triglyceride, LDL and VLDL levels.

Hence, we conclude that Laparoscopic Mini Gastric Bypass is not only an excellent treatment modality for morbid obesity, but it also improves the patient's overall quality of life by improvement in the co-morbid conditions like diabetes, hypertension and hyperlipidaemia, which are significant factors contributing to the deterioration of the patient's day-to-day life activities and predisposing to serious health issues. However, a study with a greater sample size and more duration of follow up is required to further establish the outcomes of Laparoscopic Mini Gastric Bypass.

BIBLIOGRAPHY

1. Bleich S, Cutler D, Murray C, Adams A. “why is the developed world obese?”. Annu Rev Public Health. 2008;29:273-95.
2. Rogula T, Brethauer S, Chand B, Schauer P. Bariatric Surgery as a treatment for Type 2 Diabetes. Obesity Action Coalition. Available from: http://www. obesityaction.org/educational-resources/resource-articles-2/weight-loss-surgery/bariatric-surgery-as-a-treatment-for-type-2-diabetes (Accessed on 20.11.2019).
3. Chaturvedi A, Jane N. Obesity and Insulin Resistance: an overview. J Biol Sci Opinion. 2014:2(6):369-72.
4. Christou NV, Sampalis JS, Liberman M, Look D, Auger S, McLean AP, et al. Surgery decreases long-term mortality, morbidity, and health care use in morbidly obese patients. Annals of surgery. 2004;240(3):416-23.
5. Marmuse JP, Parenti LR. Gastric bypass. Principles, complications, and results. J Visc Surg. 2010;5(147):e31-7.
6. Brethauer SA, Kim J, el Chaar M, Papasavas P, Eisenberg D, Rogers A, et al. Standardized outcomes reporting in metabolic and bariatric surgery. Surg Obes Relat Dis. 2015;11(3):489-506.
7. Milone M, Lupoli R, Maietta P, Di Minno A, Bianco P, Ambrosino P, et al. Lipid profile changes in patients undergoing bariatric surgery: a comparative study between sleeve gastrectomy and mini-gastric bypass. Int J Surg. 2015;14:28-32.
8. Coskun H, Bozkurt S, Memmi N, Cipe G, Emine Ersoy Y, Karatepe O, et al. The Efficacy of Laparoscopic Mini-Gatsric Bypass for Type-2 Diabetes in Obese patients: the Bezmialem Preliminary Report. Society of American Gatsrointestinal and Endoscopic Surgeons. Available from: https://www.sages.org/meetings/annual-meeting/abstracts-archive/the-efficacy-of-laparoscopic-mini-gastric-bypass-for-type-2-diabetes-in-obese-patients-the-bezmialem-preliminary-report.
9. Musella M, Susa A, Greco F, De Luca M, Manno E, Di Stefano C, et al. The laparoscopic mini-gatsric bypass: the Italian experience:

outcomes of 974 consecutive cases in a multicenter review. Surg. Endosc. 2014;28(1):156-63.

10. Quan Y, Huang A, Ye M, Xu M, Zhuang B, Zhang P, et al. Efficacy of Laparoscopic Mini Gastric Bypass for Obesity and Type 2 Diabetes Mellitus: A Systematic Review and Meta-Analysis. Gastroenterol Res Pract. 2015;2015:152852.
11. Lee Wj, Wang W, Lee YC, Huang MT, Ser KH, Chen JC. Effect of Laparoscopic Mini Gastric Bypass for Type 2 Diabetes Mellitus: Comparison of BMI > 35 and < 35 kg/m^2. J Gastrointest Surg. 2008;12(5):945-52.
12. Kim Z, Hur KY. Laparoscopic mini-gastric bypass for type 2 diabetes: the preliminary report. World J Surg. 2011;35(3):631-6.
13. Najm AH. Effects of Laparoscopic Mini Gastric Bypass (MGB) on Weight Loss and Biomarker Parameters in Morbidly Obese Patients: A 6-Month Follow-Up. Research Journal of Pharmacy and Technology. 2017;10(8):2517-21.
14. Rutledge R. Hospitalization before and after mini-gastric bypass surgery. Int J Surg. 2007;5(1):35-40.
15. Lee WJ, Yu PJ, Wang W, Chen TC, Wei PL, Huang MT. Laparoscopic Roux-en-Y Versus Mini-Gastric Bypass for the Treatment of Morbid Obesity A Prospective Randomized Controlled Clinical Trial. Ann Surg. 2005;242:20-8.
16. Johnson WH, Fernanadez AZ, Farrell TM, Macdonald KG, Grant JP, McMahon RL, et al. Surgical revision of loop ("mini") gastric bypass procedure: multicenter review of complications and conversions to Roux-en-Y gastric bypass. Surg Obes Relat Dis. 2007;3(1):37-41.
17. Pazouki A, Esmaeili SK. Excessive Weight Loss Following Laparoscopic Mini Gastric Bypass or Roux-En-Y Gastric Bypass Surgery. International Journal of Clinical Medicine. 2016;7:445-9.
18. Carbajo MA, Jiménez JM, Luque-de-León E, Cao MJ, López M, García S, et al. Evaluation of weight loss indicators and laparoscopic one-anastomosis gastric bypass outcomes. Sci Rep. 2018;8(1):1961.

19. Carbajo MA, Fong-Hirales A, Luque-de-León E, Molina-Lopez JF, Ortiz-de-Solórzano J. Weight loss and improvement of lipid profiles in morbidly obese patients after laparoscopic one-anastomosis gastric bypass: 2-year follow-up. Surgical endoscopy. 2017;31(1):416-21.
20. Kansou G, Lechaux D, Delarue J, Badic B, Le Gall M, Guillerm S, et al. Laparoscopic sleeve gastrectomy versus laparoscopic mini gastric bypass: One year outcomes. International Journal of Surgery. 2016;33:18-22.
21. Lessing Y, Pencovich N, Khatib M, Meron-Eldar S, Koriansky J, Abu-Abeid S. One-anastomosis gastric bypass: first 407 patients in 1 year. Obesity surgery. 2017;27(10):2583-9.
22. Musella M, Susa A, Manno E, De Luca M, Greco F, Raffaelli M, et al. Complications following the mini/one anastomosis gastric bypass (MGB/OAGB): a multi-institutional survey on 2678 patients with a mid-term (5 years) follow-up. Obesity surgery. 2017;27(11):2956-67.
23. Plamper A, Lingohr P, Nadal J, Rheinwalt KP. Comparison of mini-gastric bypass with sleeve gastrectomy in a mainly super-obese patient group: first results. Surgical endoscopy. 2017;31(3):1156-62.
24. Wang FG, Yu ZP, Yan WM, Yan M, Song MM. Comparison of safety and effectiveness between laparoscopic mini-gastric bypass and laparoscopic sleeve gastrectomy: A meta-analysis and systematic review. Medicine (Baltimore). 2017;96(50):e8924.
25. Piazza L, Di Stefano C, Ferrara F, et al. Revision of failed primary adjustable gastric banding to mini-gastric bypass: results in 48 consecutive patients. Updates Surg. 2015;67(4):433-7.
26. Carbajo MA, Luque-de-León E, Jiménez JM, Ortiz-de-Solórzano J, Pérez-Miranda M, Castro-Alija MJ. Laparoscopic one-anastomosis gastric bypass: technique, results, and long-term follow-up in 1200 patients. Obes Surg. 2017;27(5):1153-67.

27. Wang W, Wei PL, Lee YC, Huang MT, Chiu CC, Lee WJ. Short-term results of laparoscopic mini-gastric bypass. Obes Surg. 2005;15(5):648-54.
28. Rutledge R. The mini-gastric bypass: experience with the first 1,274 cases. Obes Surg. 2001;11(3):276-80.
29. Abdallah El-Husseiny M, Abdel-Moneim AA, Abdel-Maksoud MA, Hammad KS. The Role of Laparoscopic Mini-Gastric Bypass in Management of Metabolic Syndrome. Diabetes Metab Syndr. 2018;12(4):491-5.
30. Noun R, Skaff J, Riachi E, Daher R, Antoun NA, Nasr M. One thousand consecutive mini-gastric bypass: short-and long-term outcome. Obes Surg. 2012;22(5):697-703.
31. Piazza L, Ferrara F, Leanza S, Coco D, Sarvà S, Bellia A, et al. Laparoscopic mini-gastric bypass: short-term single-institute experience. Updates Surg. 2011;63(4):239-42.
32. Chakhtoura G, Zinzindohoué F, Ghanem Y, Ruseykin I, Dutranoy JC, Chevallier JM. Primary results of laparoscopic mini-gastric bypass in a French obesity-surgery specialized university hospital. Obes Surg. 2008;18(9):1130-3.
33. Rutledge R, Walsh TR. Continued excellent results with the mini-gastric bypass: six-year study in 2,410 patients. Obes Surg. 2005;15(9):1304-8.
34. Peraglie C. Laparoscopic mini-gastric bypass (LMGB) in the super-super obese: outcomes in 16 patients. Obes Surg. 2008;18(9):1126-9.
35. Sampalis JS, Liberman M, Auger S, Christou NV. The impact of weight reduction surgery on health-care costs in morbidly obese patients. Obes Surg. 2004;14(7):939-47.
36. Jammu GS, Sharma R. A 7-Year Clinical Audit of 1107 Cases Comparing Sleeve Gastrectomy, Roux-En-Y Gastric Bypass, and Mini-Gastric Bypass, to Determine an Effective and Safe Bariatric and Metabolic Procedure. Obes Surg. 2016;26(5):926-32.
37. Peraglie C. Laparoscopic mini-gastric bypass in patients age 60 and older. Surg Endosc. 2016;30:38-43.

38. Disse E, Pasquer A, Espalieu P, Poncet G, Gouillat C, Robert M. Greater weight loss with the omega loop bypass compared to Roux-en-Y gastric bypass: a comparative study. Obes Surg. 2014;24:841-6.
39. Carbajo MA, Vazquez-Pelcastre R, Aparicio-Ponce R, Luque De Lyon E, Jimenez JM, Ortiz-Solarzano J, et al. 12-year old adolescent with super morbid obesity, treated with laparoscopic one anastomosis gastric bypass (LOAGB/BAGUA): A case report after 5-year follow-up. Nutr Hosp. 2015;31:2327-32.
40. Carbajo MA, Jimenez JM, Castro MJ, Ortiz-Solorzano J, Arango A. Outcomes and weight loss, fasting blood glucose and glycosylated hemoglobin in a sample of 415 obese patients, included in the database of the European Accreditation Council for Excellence Centers for Bariatric Surgery with Laparoscopic One Anastomosis Gastric Bypass. Nutr Hosp. 2014;30:1032-8.
41. Garcia-Caballero M, Valle M, Martinez-Moreno JM, Miralles F, Toval JA, Mata JM, et al. Resolution of diabetes mellitus and metabolic syndrome in normal weight 24-29 BMI patients with one anastomosis gastric bypass. Nutr Hosp. 2012;27:623-31.
42. Milone M, Di Minno MN, Leongito M, Maietta P, Bianco P, Taffuri C, et al. Bariatric surgery and diabetes remission: sleeve gastrectomy or mini-gastric bypass? World J Gastroenterol. 2013;19:6590-7.
43. Georgiadou D, Sergentanis TN, Nixon A, Diamantis T, Tsigris C, Psaltopoulou T. Efficacy and safety of laparoscopic mini-gastric bypass. A systematic review. Surg Obes Relat Dis. 2014;10:984-91.
44. Bruzzi M, Rau C, Voron T, Guenzi M, Berger A, Chevallier JM. Single anastomosis or mini-gastric bypass: long-term results and quality of life after a 5- year follow-up. Surg Obes Relat Dis. 2015;11:321-6.
45. Alberti KG, Eckel RH, Grundy SM, Zimmet PZ, Cleeman J, Donato K, et al. A joint interim statement of the International Diabetes Federation Task Force on Epidemiology and Prevention; National Heart, Lung, and Blood Institute; American Heart Association; World Heart Federation; International Atherosclerosis Society; and

International Association for the Study of Obesity. Circulation. 2009;120(16):1640-5.

46. Snow V, Barry P, Fitterman N, Qaseem A, Weiss K. Pharmacologic and surgical management of obesity in primary care: a clinical practice guideline from the American College of Physicians. Ann Intern Med. 2005;142(7):525-31.
47. Deitel M, Hargroder D, Peraglie C. Mini-gastric bypass for bariatric surgery increasing worldwide. Austin J Surg. 2016;3 (3):1092-6.
48. Musella M, Apers J, Rheinwalt K, Ribeiro R, Manno E, Greco F, et al. Efficacy of bariatric surgery in type 2 diabetes mellitus remission: the role of mini gastric bypass/one anastomosis gastric bypass and sleeve gastrectomy at 1 year of follow-up. A European survey. Obes Surg. 2016;26(5):933-40.
49. Chevallier JM. Effects of MGB on Obesity-Related Co-Morbidities: Lipids, Hypertension, Non-Alcoholic Fatty Liver, etc. Essentials of Mini–One Anastomosis Gastric Bypass. 2018:111-7.
50. Kular KS, Manchanda N, Rutledge R. Analysis of the five-year outcomes of sleeve gastrectomy and mini-gastric bypass: a report from the Indian subcontinent. Obes Surg. 2014;24:1724-8.
51. Lee WJ, Ser KH, Lee YC, Tsou JJ, Chen SC, Chen JC. Laparoscopic Roux-en-Y vs. mini-gastric bypass for the treatment of morbid obesity: a 10-year experience. Obes Surg. 2012;22(12):1827-34.
52. Jammu GS. Comparison of Results of Mini-Gastric Bypass to Sleeve Gastrectomy and Roux-en-Y Gastric Bypass. Technique of Conversion of Failed Sleeve Gastrectomy to MGB. Essentials of Mini–One Anastomosis Gastric Bypass. 2018:201-3.

Sr. No	Name	Cr. No	Age	Gender	Height	Ideal Weight	Weight				% Excess Weight Loss		BMI				FBS				HbA1c				SBP		
							Before Surgery	Post Op Day 1	3 Months Post Op	6 Months Post Op	3 Months Post Op	6 Months Post Op	Before Surgery	Post Op Day 1	3 Months Post Op	6 Months Post Op	Before Surgery	Post Op Day 1	3 Months Post Op	6 Months Post Op	Before Surgery	Post Op Day 1	3 Months Post Op	6 Months Post Op	Before Surgery	Post Op Day 1	3 Months Post Op
1	RKS	434517	45	m	1.7	64.1	126.1	126.1	114.1	101.2	19.4	40.1	45.2	44.5	40.9	36.3	114	115	127	112	6.1	6	5.7	5.2	140	140	130
2	SS	497233	45	f	1.5	54.5	120.5	120.5	108.6	96.8	18.0	36.0	50.8	50.8	45.8	40.8	110	121	119	117	6.2	6	5.9	5.4	170	160	140
3	SV	500753	50	m	1.7	64.1	123.3	123.3	116.3	109.3	11.8	23.6	34.2	33.4	31.7	29.2	163	170	159	147	8.3	8.2	7.7	6.9	130	110	120
4	MK	501956	76	f	1.6	56.7	105.0	105.0	93.2	84.1	24.5	43.4	42.6	42.2	37.8	34.1	163	110	121	131	5.9	5.5	5.4	5.2	130	130	120
5	D	220398	38	f	1.5	53.8	115.2	115.2	100.7	89.7	23.7	41.6	49.2	49	43	38.3	190	147	138	124	8	7.9	7.2	6.6	140	140	130
6	KK	217610	47	f	1.5	51.8	94.1	94.1	86.6	77.0	17.6	40.4	41.8	41.3	38.5	36.2	101	107	110	115	6.1	6.1	5.8	5.2	130	140	140
7	SR	301512	51	f	1.7	64.1	116.0	116.0	106.5	92.9	18.3	44.6	41.6	41.2	38.2	36.3	163	157	142	110	7.8	7.6	7.1	6.6	140	140	130
8	SR	501070	54	f	1.7	66.5	116.8	116.8	110.7	99.7	12.1	33.9	40.4	40.2	38.3	34.5	171	167	152	127	10.4	10.2	9	7.7	150	150	140
9	SB	501976	57	f	1.7	62.6	130.1	130.1	124.1	116.5	8.9	20.2	37.8	37.1	35.6	32.8	202	193	154	134	5.6	5.6	5.3	5.2	140	140	130
10	SD	253125	71	f	1.7	66.5	141.9	141.9	125.7	119.9	21.5	29.1	49.1	48.9	43.5	41.5	187	179	135	129	9.5	9.4	8.3	7.7	160	150	140
11	SS	482434	60	m	1.7	64.1	125.5	125.5	118.5	111.8	11.4	22.3	35	34.2	32.5	30.1	212	189	161	136	8.2	8.1	7.4	6.7	160	150	130
12	JK	366106	59	f	1.6	60.4	120.5	120.5	109.4	101.8	18.3	31.0	35.9	34.6	31.7	28.8	137	126	119	121	6.3	5.9	5.7	5.5	110	120	110
13	VT	463161	62	f	1.7	68.0	135.8	135.8	119.5	111.8	24.0	35.4	35.9	34.5	30.4	27.8	212	186	152	126	7.6	7.4	6.8	6.2	140	130	120
14	NK	506167	58	m	1.7	66.5	157.8	157.8	128.9	111.8	31.6	50.3	54.6	52.5	44.6	38.7	221	202	173	131	6.9	6.8	5.9	5.3	160	150	140
15	PJ	512731	33	f	1.7	62.6	161.7	161.7	136.9	120.9	25.0	41.2	59.4	58	50.3	44.4	190	187	163	141	7.3	7.2	6.3	5.9	150	140	130
16	GS	527853	26	m	1.7	68.0	134.9	134.9	113.9	98.2	31.4	54.9	45.6	45.3	38.5	33.2	187	167	137	107	7.1	7	6.3	5.6	140	130	120
17	AT	541189	28	m	1.7	66.5	118.8	118.8	97.7	86.7	40.3	61.3	41.1	40.4	33.8	30	157	151	133	121	6.8	6.7	5.8	5.5	140	130	120
18	BSS	583247	62	m	1.7	66.5	132.7	132.7	122.2	114.4	15.7	27.5	35.9	35.4	32.3	29.6	197	193	176	141	5.5	5.4	5.2	5.1	140	130	120
19	NS	768776	66	f	1.6	60.4	115.7	115.7	104.7	97.6	19.9	32.7	34.1	33.7	29.9	27.2	156	147	129	117	6.4	6.3	5.9	5.5	160	150	130
20	MK	593209	30	f	1.7	62.6	117.1	117.1	109.4	102.6	14.0	26.5	33	32.7	30.2	27.7	127	121	117	109	6	6	5.8	5.3	140	140	130
21	BS	599685	50	m	1.7	68.0	110.9	110.9	101.5	92.6	22.1	42.8	37.5	36.9	34.3	31.3	232	187	157	122	7.2	7.1	6.3	5.8	160	150	140
22	RK	612196	41	f	1.6	60.4	103.4	103.4	90.3	85.3	30.5	42.1	39.4	37.4	34.4	32.5	157	149	132	121	6.8	6.7	6.1	5.7	150	140	130
23	JK	617701	45	f	1.7	64.1	130.0	130.0	119.6	113.2	15.7	25.4	36.6	35.6	32.9	30.6	132	119	103	110	5.8	5.7	5.4	5.3	140	140	130
24	RK	635050	32	f	1.7	64.1	126.9	126.9	114.9	104.0	19.1	36.4	35.5	34.9	31.2	27.3	186	170	150	139	8.6	8.4	7.7	7.1	140	140	120
25	MG	647634	56	f	1.7	64.1	139.2	139.2	125.2	109.6	18.6	39.4	39.9	39.5	34.9	29.3	163	156	141	121	9.1	9	8.3	7.6	160	150	130
26	CK	23037	44	f	1.7	66.5	140.7	140.7	128.6	116.8	16.3	32.3	48.7	48.2	44.5	40.4	260	251	190	161	10.3	10.1	8.8	7.1	170	160	140
27	RK	31245	27	f	1.7	62.6	126.9	126.9	101.8	86.0	39.0	63.6	46.6	46.2	37.4	31.6	151	149	138	121	6.9	6.8	6.5	6.3	140	140	130
28	RB	24130	46	m	1.7	66.5	165.6	165.6	135.8	115.9	30.0	50.1	57.3	57	47	40.1	270	122	180	140	12.9	12.7	9.1	7.1	170	160	140
29	AC	29169	40	m	1.7	68.0	168.6	168.6	144.7	121.0	23.8	47.4	57	56.1	48.9	40.9	182	184	154	136	7.6	7.6	6.8	6.1	140	140	130
30	GS	40167	37	m	1.7	66.5	129.8	129.8	108.7	93.9	33.3	56.6	44.9	44.5	37.6	32.5	160	155	142	122	7	7	6.4	6.1	140	140	130
31	RK	31820	42	f	1.7	64.1	110.2	110.2	96.2	83.4	30.3	58.2	39.5	39.1	34.5	29.9	146	142	131	123	6.8	6.8	6.2	5.9	150	140	130
32	CK	16376	39	f	1.7	66.5	156.6	156.6	138.1	117.6	20.5	43.3	54.2	53.9	47.8	40.7	281	267	186	150	8.7	8.7	7.3	6.7	160	150	140
33	KM	24707	54	f	1.7	66.5	149.7	149.7	121.7	100.9	33.7	58.7	51.8	51.4	42.1	34.9	149	142	133	119	6.9	6.9	6.3	5.8	170	160	140
34	IB	26281	60	f	1.7	64.1	124.9	124.9	109.0	97.3	26.1	45.4	44.8	44.1	39.1	34.9	270	261	197	152	9.3	9.3	7.1	6.8	140	130	130
35	AK	25435	30	f	1.7	66.5	114.7	114.7	97.7	84.7	35.3	62.3	39.7	39.4	33.8	29.3	177	172	151	130	6.9	6.9	6.4	6.1	160	150	140
36	GS	32632	40	m	1.8	70.4	175.5	175.5	154.7	130.5	19.8	42.9	57.3	57	50.5	42.6	157	152	141	126	6.8	6.8	6.1	5.7	150	140	130
37	SB	32824	57	f	1.7	66.5	130.6	130.6	115.9	104.9	23.0	40.1	45.2	44.5	40.1	36.3	298	276	182	156	8.9	8.9	7.8	6.7	160	150	130
38	LS	31723	36	m	1.7	68.0	174.5	174.5	140.8	113.9	31.7	56.9	59	58.3	47.6	38.5	176	172	152	136	7.1	7.1	6.8	6.4	140	130	130
39	SK	37287	65	f	1.7	66.5	139.6	139.6	123.7	105.8	21.7	46.2	48.3	48	42.8	36.6	160	140	147	131	6.9	6.9	6.5	6.3	140	140	130
40	GB	14175	27	f	1.7	64.1	118.0	118.0	95.4	84.2	42.0	62.7	42.3	41.6	34.2	30.2	147	145	137	123	6.8	6.8	6.4	6.1	130	140	130
41	MA	25839	36	m	1.7	66.5	116.8	116.8	101.7	90.7	29.9	51.7	40.4	40.1	35.2	31.4	167	159	148	128	6.8	6.8	6.5	6.1	150	140	130
42	SG	23199	36	f	1.7	66.5	132.7	132.7	108.7	96.8	36.2	54.1	45.9	45.6	37.6	33.5	143	141	137	127	6.5	6.5	6.2	6	130	130	120
43	S	22206	50	f	1.6	60.4	108.1	108.1	95.3	83.5	26.9	51.6	41.2	40.9	36.3	31.8	151	147	136	127	6.7	6.7	6.1	5.9	140	130	130
44	RT	21794	50	f	1.6	56.7	94.4	94.4	84.5	77.6	26.1	44.4	38.3	37.9	34.3	31.5	172	168	149	137	7.3	7.3	6.8	6.5	140	140	130
45	NW	36701	47	f	1.7	62.6	104.8	104.8	92.0	82.8	30.3	52.3	38.5	38.1	33.8	30.4	163	160	151	137	6.4	6.4	6.1	5.9	130	130	130
46	BK	38636	58	f	1.7	64.1	124.1	124.1	115.2	107.1	14.9	28.4	44.5	43.9	41.3	38.4	149	144	132	123	6.4	6.4	6.1	5.7	140	130	120
47	VJ	43982	29	m	1.7	66.5	149.7	149.7	101.7	72.8	57.6	92.4	51.8	51.1	35.2	25.2	159	151	137	117	6.9	6.9	6.5	5.9	140	130	120
48	GK	37319	48	f	1.7	66.5	161.6	161.6	135.8	124.8	27.1	38.6	55.9	55.4	47	43.2	153	149	132	121	6.7	6.7	6.4	6.1	140	130	120
49	VL	30135	42	f	1.7	66.5	151.7	151.7	119.6	102.9	37.6	57.3	52.5	52.1	41.4	35.6	170	151	130	120	6.5	6.5	5.7	5.6	140	140	130
50	RM	75165	55	f	1.6	60.4	104.2	104.2	95.0	85.6	21.0	42.5	36.7	36.1	32.2	27.6	272	226	196	162	8.7	8.6	7.9	6.3	150	130	120

Sr. No	Name	Cr. No		DBP				Triglycerides				HDL				LDL				VLDL				Post Op Complications
			6 Months Post Op	Before Surgery	Post Op Day 1	3 Months Post Op	6 Months Post Op	Before Surgery	Post Op Day 1	3 Months Post Op	6 Months Post Op	Before Surgery	Post Op Day 1	3 Months Post Op	6 Months Post Op	Before Surgery	Post Op Day 1	3 Months Post Op	6 Months Post Op	Before Surgery	Post Op Day 1	3 Months Post Op	6 Months Post Op	
1	RKS	434517	130	80	90	80	70	107	108	103	98	42	43	40	37	137	136	126	122	22	22	20	20	nausea
2	SS	497233	130	100	90	90	80	241	239	210	190	30	30	32	35	48	141	131	125	48	47	42	38	none
3	SV	500753	110	80	70	70	80	225	220	196	180	42	42	44	47	174	171	166	150	45	44	39	36	marginal ulcer
4	MK	501956	110	90	70	70	80	175	173	156	145	31	33	35	39	126	124	115	109	35	35	33	31	none
5	D	220398	130	90	80	80	70	104	105	110	90	40	40	42	45	119	118	110	102	21	21	20	18	nausea
6	KK	217610	130	80	80	90	80	242	240	225	200	42	43	45	46	102	100	105	110	48	48	45	40	diarrhoea
7	SR	301512	130	90	80	70	80	201	200	155	130	35	36	38	40	78	80	80	82	40	40	35	32	none
8	SR	501070	130	90	80	80	80	133	130	90	90	34	34	37	40	100	101	96	92	26	25	22	20	nausea
9	SB	501976	120	90	80	70	70	97	98	94	80	46	46	48	49	96	97	98	92	20	21	22	20	diarrhoea
10	SD	253125	130	90	90	80	80	92	90	86	84	27	28	30	32	42	44	40	38	31	30	21	20	none
11	SS	482434	120	90	90	80	70	155	150	136	122	40	42	46	48	124	120	110	102	51	48	38	32	diarrhoea
12	JK	366106	120	70	70	80	80	148	142	132	112	42	43	48	49	140	134	118	102	50	48	42	38	none
13	VT	463161	110	90	90	70	70	238	230	196	176	40	42	46	48	156	150	130	103	48	46	40	34	nausea
14	NK	506167	130	90	90	80	80	185	168	122	98	31	33	38	42	140	136	112	92	46	42	36	31	none
15	PJ	512731	110	90	90	80	80	146	142	133	106	44	45	47	48	138	132	124	103	52	48	43	36	GERD
16	GS	527853	110	90	90	70	70	141	136	112	102	46	41	51	54	128	122	102	86	43	40	36	32	marginal ulcer
17	AT	541189	110	90	90	80	70	136	128	102	91	46	44	48	49	128	122	112	98	49	43	38	33	none
18	BSS	583247	110	90	90	70	70	276	236	212	186	32	36	40	45	85	80	75	66	49	45	41	37	nausea
19	NS	768776	120	90	90	80	70	135	127	115	98	40	42	45	48	89	88	82	74	43	40	37	32	none
20	MK	593209	130	90	90	80	70	350	300	230	190	28	30	36	40	116	114	101	92	53	50	46	36	none
21	BS	599685	130	100	100	80	70	189	172	151	131	31	33	40	42	124	121	106	98	48	46	42	32	GERD
22	RK	612196	120	90	90	90	70	708	538	232	180	32	40	44	46	136	132	112	106	51	47	42	36	diarrhoea
23	JK	617701	130	80	80	90	70	65	64	62	60	67	72	78	50	102	100	98	92	25	24	22	20	none
24	RK	635050	120	90	80	70	80	98	97	89	87	54	51	50	47	113	112	106	102	26	25	21	20	none
25	MG	647634	130	100	100	90	80	70	69	66	64	41	41	43	45	94	93	89	85	21	20	18	17	nausea
26	CK	23037	130	100	90	90	90	131	127	121	111	44	45	48	49	150	144	140	132	42	36	36	30	GERD
27	RK	31245	120	90	90	80	70	102	100	98	82	42	42	45	46	130	129	121	103	40	38	36	29	none
28	RB	24130	130	100	90	80	90	170	166	144	121	46	45	41	49	180	175	151	131	62	60	51	48	diarrhoea
29	AC	29169	130	90	80	90	80	170	162	152	144	48	45	42	35	145	142	128	124	42	40	30	26	marginal ulcer
30	GS	40167	130	100	90	80	70	142	138	132	130	44	45	47	48	152	146	128	122	30	28	29	25	GERD
31	RK	31820	130	90	90	80	70	138	130	126	122	36	42	45	48	144	140	132	130	40	42	36	34	diarrhoea
32	CK	16376	130	90	90	80	70	192	190	157	141	40	41	45	49	160	160	142	131	48	47	38	29	GERD
33	KM	24707	130	100	90	80	80	150	146	140	133	48	48	46	45	139	138	129	122	40	40	32	28	none
34	IB	26281	120	80	90	80	70	139	138	130	125	42	40	46	48	147	146	133	121	38	37	29	27	none
35	AK	25435	130	100	90	90	80	147	144	140	133	48	46	47	49	130	128	124	118	37	35	31	26	GERD
36	GS	32632	120	90	90	90	70	148	145	136	131	48	48	50	47	136	132	126	118	33	30	27	22	nausea
37	SB	32824	130	90	90	90	80	152	146	140	135	43	44	47	49	148	146	138	129	36	34	30	28	none
38	LS	31723	120	90	90	80	70	142	139	131	125	46	47	42	49	131	127	122	119	39	36	31	27	none
39	SK	37287	130	90	80	90	80	148	145	140	127	40	38	42	46	138	137	132	130	36	36	34	28	GERD
40	GB	14175	130	100	90	80	70	136	131	127	121	41	42	46	49	143	141	137	132	38	36	33	29	none
41	MA	25839	120	90	80	80	70	141	139	131	127	37	39	44	47	132	131	126	122	32	33	29	26	GERD
42	SG	23199	110	90	80	70	70	142	139	136	130	33	36	41	46	131	130	127	124	41	40	37	31	bile reflux
43	S	22206	130	90	90	80	70	140	136	131	124	40	42	46	49	138	137	133	129	36	35	32	27	none
44	RT	21794	130	90	90	90	80	138	136	130	130	38	38	44	47	142	140	130	123	39	37	32	29	GERD
45	NW	36701	120	90	90	80	70	138	137	131	127	38	40	44	49	126	125	119	110	32	32	27	24	bile reflux
46	BK	38636	120	80	80	70	90	126	120	112	103	41	42	46	49	135	133	129	124	35	31	27	22	nausea
47	VJ	43982	110	90	80	70	70	120	117	110	102	37	39	42	47	141	138	130	121	34	32	18	15	none
48	GK	37319	110	80	80	70	70	150	140	130	117	39	41	45	48	131	128	121	113	20	21	17	14	nausea
49	VL	30135	130	90	80	80	70	140	130	123	120	38	39	42	44	131	123	117	111	30	28	23	20	none
50	RM	75165	110	90	90	70	70	125	117	115	110	39	40	42	45	112	110	105	102	22	20	18	16	none

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The Principal,
DMC, Ludhiana.

Subject: **Approval of Plan of Thesis.**

This is to inform you that the Faculty of Medical Sciences in its meeting held on 31.08.2018 has approved the plan of thesis of Dr.'Sameer Mittu, a student of your college for MS General Surgery along with the names of Supervisor/Co-Supervisor as under:-

Topic Plan of Thesis
Evaluation of outcome following mini gastric bypass surgery for morbid obesity

Supervisor	Co-Supervisor
Dr. Prabhdeep S. Nain Prof., Dept. of Surgery, DMCH, Ludhiana.	Dr. Ashish Ahuja Assoc. Prof., Dept. of Surgery, DMCH, Ludhiana..

The student may submit the four copies of thesis, to the Controller of Examinations, BFUHS, Faridkot, at least six months before the commencement of theory examination, if he/she is otherwise eligible to take the examination. He /She may be directed to attach a photocopy of this letter with the forwarding letter while submitting thesis in the University along with the letter of approval of University for change of supervisor/Co-Supervisor, change of topic, if any.

SPSingh
Dr. S P Singh MS(Oph)
Controller of Examinations

Note :

1. *If any discrepancy found regarding topic of thesis or Supervisor/Co-Supervisor, inform undersigned within one month after issue of this letter.*
2. *The student may submit the thesis as per the schedule already conveye l i.e for May/June examination 30th Nov of the preceding the year of examination and for Nov/Dec examinations . 1st May of the year of examination.*

EVALUATION OF OUTCOME FOLLOWING MINI GASTRIC BYPASS SURGERY FOR MORBID OBESITY

THESIS PROPOSAL

FOR APPROVAL OF SUBJECT OF THESIS TO BE SUBMITTED

IN PARTIAL FULFILMENT OF THE REQUIREMENTS

FOR THE DEGREE OF

M.S

in

Surgery

OF THE

BABA FARID UNIVERSITY OF HEALTH SCIENCES
FARIDKOT

January, 2018

DR. SAMEER MITTU

DEPARTMENT OF SURGERY
DAYANAND MEDICAL COLLEGE AND HOSPITAL
LUDHIANA

ABSTRACT OF PLAN OF THESIS

Title	**EVALUATION OF OUTCOME FOLLOWING MINI GASTRIC BYPASS SURGERY FOR MORBID OBESITY**
For the degree of	**M.S. in General Surgery**
Name of the candidate	**Dr. Sameer Mittu**
Supervisor	**Dr. P.S. Nain,** Professor, Department of Surgery Dayanand Medical College & Hospital, Ludhiana
Co-supervisor	**Dr. Ashish Ahuja,** Associate Professor, Department of Surgery, Dayanand Medical College & Hospital, Ludhiana
Institution	Dayanand Medical College & Hospital, Ludhiana
University	Baba Farid University of Health Sciences, Faridkot

Introduction: Obesity has emerged as one of the most serious public health concerns in the 21st century. The consequences of this chronic disorder are serious which include type 2 diabetes, hypertension, hyperlipidemia and others. Bariatric Surgery, particularly Laparoscopic Mini Gastric Bypass, is a simple and effective treatment modality for morbidly obese patients.

Aim of Study:

To evaluate the outcomes for Mini Gastric Bypass Surgery in terms of :

1. BMI
2. Diabetic Status
3. Hypertensive Status
4. Lipid Profile
5. Post-Operative Complications

Materials & Methods: Obese Patients presenting to DMCH with Morbid Obesity who have undergone or will undergo Laparoscopic Mini Gastric Bypass Surgery in the Department of Surgery, DMCH, Ludhiana. Prospective cases will include admissions from January, 2018 to December, 2018. Retrospective cases will include admissions from January 2015 to December, 2017. Follow up will include 6 months from the date of surgery.

Clinical Significance:

Laparoscopic Mini Gastric Bypass is a comparatively newer technique of bariatric surgery which has been in controversies for its impact on the patient's overall health and certain complications affecting its acceptance worldwide. Data on the benefits of LMGB on weight reduction, diabetic and hypertensive status and lipid profile is limited. This study will help us understand the effectiveness of LMGB in improving the overall health status of morbidly obese patients.

Keywords: Laparoscopic Mini Gastric Bypass, Bariatric Surgery, Weight, BMI, Type 2 Diabetes Mellitus, Hypertension, Lipid Profile.

(Signature)	(Signature)	(Signature)	(Signature)
Candidate	Co-supervisor	Supervisor	Principal

CERTIFICATE OF FACILITIES AVAILABLE

This is to certify that the facilities for work on the subject of thesis titled **"EVALUATION OF OUTCOME FOLLOWING MINI GASTRIC BYPASS SURGERY FOR MORBID OBESITY"** exist in the Department of Surgery, DMC&H, Ludhiana and will be provided to the candidate. We will see that the data being included in the thesis is genuine and is collected by the candidate herself under our supervision and guidance.

Supervisor

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Professor
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Co-Supervisor

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Dr. Jaspal Singh
Professor & Head
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Place : LUDHIANA

Date : 17/1/18

APPROVAL PROFORMA
BY
RESEARCH & ETHICAL COMMITTEE
DAYANAND MEDICAL COLLEGE & HOSPITAL, LUDHIANA

Name of candidate	Dr. Sameer Mittu
Department	Surgery
Topic of Thesis	EVALUATION OF OUTCOME FOLLOWING MINI GASTRIC BYPASS SURGERY FOR MORBID OBESITY
Likely date of appearing in PG examination	MAY 2020
Date of enrollment	31st May, 2017
Name of Head of Department	Dr. Jaspal Singh
1) Supervisor	Dr. P.S. Nain
2) Co-Supervisor(s)	Dr. Ashish Ahuja

Signature of Members of Research Committee with Stamp	**Signature of Members of Ethics Committee with Stamp**
1. HOD Pharmacology	1. HOD Physiology
2. HOD Surgery	2. HOD Pathology
3. HOD Pathology	3. HOD Pharmacology
4. HOD Medicine	4. HOD SPM
5. Dean Academics	5. HOD Medicine
6. Vice Principal	6. HOD Surgery
	7. HOD Obst. & Gynae
	8. Legal Expert
	9. Secretary, IEC
	10. Dean Academics
	11. Vice Principal
	12. Principal

Approved : (Yes) / No

Chairperson
Research Committee

Chairperson
Research Committee

Approved : (Yes) / No

Chairperson
Ethics Committee

Chairperson
Ethics Committee

BABA FARID UNIVERSITY OF HEALTH SCIENCES, FARIDKOT

PROFORMA FOR REGISTRATION OF SUBJECT FOR DISSERTATION

1	NAME OF THE CANDIDATE AND ADDRESS	Dr. Sameer Mittu 99-100-C Rishi Nagar Ludhiana -141001 Punjab
2	NAME OF THE INSTITUTE	Dayanand Medical College & Hospital
3	COURSE OF STUDY AND SUBJECT	SURGERY (MS)
4	DATE OF ADMISSION OF COURSE	31st May, 2017
5	TITLE OF THE TOPIC	EVALUATION OF OUTCOME FOLLOWING MINI GASTRIC BYPASS SURGERY FOR MORBID OBESITY

6. BRIEF RESUME OF THE INTENDED WORK

6.1 NEED FOR THE STUDY

Obesity has emerged as one of the most serious public health concerns in the 21st century. The consequences of this chronic disorder are serious. In Obesity, excess body fat accumulates to the extent that it may have a negative impact on health, leading to reduced life expectancy and increased health problems. It can lead to a number of serious and potentially life-threatening conditions which affect essentially every organ system like CVS, respiratory, metabolic, musculoskeletal, endocrine, reproductive, dermatological, and neurological. It can also affect the quality of life and lead to psychological problems like low self-esteem or even depression.

Treatment options for obesity include non-surgical treatment and bariatric surgery. The non-surgical treatment is usually a multicomponent approach comprising behavioral therapy, dietary changes with the main aim of reducing energy intake, increasing physical activity, and various pharmacotherapies. The results of medical treatment of obesity have been disappointing. Surgical techniques for obesity management continue to gain broader implementation possibilities. And despite late introduction as a treatment modality, it is gaining popularity not only as the first step in the staged treatment of super morbid obesity in patients from high-risk groups but mainly as an isolated definitive bariatric procedure. Its increasing popularity among bariatric surgeons and patient's acceptance of its impact on body mass reduction started in 2003.

Surgical intervention in obesity is today the most effective treatment method in high-level obesity management with long-term clinical results and satisfaction of operated patients. A high percentage of patients benefit from bariatric surgery procedures in terms of metabolic effect and substantial body mass index reduction. These procedures improve glucose metabolism leading to the amelioration or complete resolution of type 2 diabetes and alleviation of metabolic syndrome effects. Bariatric surgery interventions not only ensure body weight reduction but also influence lipid and saccharide metabolism as well. Bariatric surgery has been shown to eliminate co-morbid conditions associated with obesity. Surgical procedures are considered most effective therapy for long-term weight loss. It is a life-saving surgery and not cosmetic surgery. Long-term survival is better in the surgically treated group rather than in those managed medically. Some of these operations lead to the rapid remission of Type 2 Diabetes and Hypertension in a weight loss independent manner. Bariatric Surgery is usually considered when other weight loss efforts have failed.

The mini gastric bypass procedure was first developed by Robert Rutledge from the US in 1997, as a modification of the standard Billroth II procedure. A mini gastric bypass creates a long narrow tube of the stomach along its right border (the lesser curvature). A loop of the small gut is brought up and hooked to this tube at about 180 cm from the start of the intestine. The MGB has been suggested as an alternative to the Roux en-Y procedure due to the simplicity of its construction, and is becoming more and more popular because of low risk of complications and good sustained weight loss. It has

been estimated that 15.4% of weight loss surgery in Asia is now performed via the MGB technique.[13]

Rutledge's Laparoscopic mini-gastric bypass (LMGBP), was proposed as a simple and effective treatment of morbid obesity. However, controversies about the relative efficacy of this procedure remain, concerning its effect on weight loss, lipid profile, comorbid conditions like type 2 diabetes mellitus and hypertension, and development of post-operative complications.

This study to be conducted in the Department of General Surgery in Dayanand Medical College & Hospital will evaluate the changes in the weight/BMI, improvement in diabetic and hypertensive status, changes in the lipid profile and occurrence of postoperative complications, if any, in patients diagnosed with morbid obesity who undergo Laparoscopic Mini Gastric Bypass Surgery.

6.2 REVIEW OF LITERATURE

Obesity has become an epidemic. The world's overweight population is already greater than its underweight population and the numbers of overweight individuals are rapidly on the increase, leading to a global obesity pandemic. Once considered a problem only in high-income countries, overweight and obesity are now dramatically on the rise in all countries.

WHO has declared obesity as a global epidemic. 1/3rd of the global population (about 2.1 billion people) is now overweight or obese, 671 million of which fall into the obese category. It is a leading preventable cause of death worldwide, with increasing rates in adults and children and is seen as one of the most serious public health problems of the 21st century.

According to a study published in the noted journal Lancet, India stands third, just behind US and China in the global hazard list of top 10 countries with the highest number of obese. Obesity is most commonly caused when food calorie intake exceeds energy expenditure over a long period of time, although a few cases are caused primarily due to genetic susceptibility, endocrine disorders, medications or psychiatric illness.

Obesity is a very important factor in the development of type 2 diabetes. This disease is marked by high levels of sugar in the blood and occurs when the body does not respond correctly to insulin, a hormone released by the pancreas. An obese person has double the risk of developing diabetes and a severely obese person is at a tenfold increased risk. Recent studies show that fat tissues change following bariatric surgery, which leads to improvement of insulin resistance. Bariatric surgery improves diabetes not only through rapid-weight loss but also by excluding (bypassing) a portion of

the small intestine from the flow of nutrients. This means that gastric bypass surgery improves diabetes even before the weight loss. The production of various gut hormones is changed following gastric bypass, leading to improvement of insulin secretion.

Obesity is measured and defined in terms of Quetelet's Body Mass Index (BMI) which is a ratio of weight (kilograms) to height (square meter) of an individual. Normal BMI ranges from 20-25 kg/m^2. BMI > 30 kg/m^2 indicates obesity. A BMI of > 35 kg/m^2 and experiencing obesity-related health conditions or > 40-44.9 kg/m^2 is morbid obesity.

Nutritional Status	WHO-Criteria BMI	Asian-Criteria WPRO
Underweight	<18.5	<18.5
Normal	18.5 - 24.9	18 - 22.9
Overweight	25 - 29.9	23 – 24.9
Pre-Obese	-	-
Obese 1 (Obese)	30 – 34.9	25 – 29.9
Obese 2 (Morbid Obese)	35 – 39.9	>30
Obese 3 (Severe Obese)	>40	
Super Obese	>50	

WPRO - western pacific region of WHO Criteria pertaining to Obesity (WPRO – criteria, 2000)

Research into the relationship between obesity and the changes in the levels of blood glucose, blood pressure, various lipoproteins and triglycerides following Laparoscopic Mini Gastric Bypass Surgery has been limited because of the issues in worldwide acceptance of this technique.

Bariatric surgery is presently a typical method around the world. It adequately brings down body weight and resolves obesity related

complexities, and is better than different methods for weight loss. Uncommonly, for obesity individuals in prediabetes condition, weight control could bring down the danger or postpone the onset of T2DM, with strict calorie confinement not withstanding turning around the movement of T2DM in set up patients. Progressive, a few bariatric surgeries exist. Laparoscopic adjustable gastric banding (LAGB), laparoscopic sleeve gastrostomy (LSG), and laparoscopic Roux-en-Y gastric bypass (LRYGB) are the three most usually utilized bariatric surgeries and LRYGB, went with more fast and more significant weight reduction than "restrictive" strategy (LAGB) and less danger of disappointment or intricacy than the "malabsorptive" method (LSG), is for the most part considered as the "gold standard" procedure. Laparoscopic mini-gastric bypass (MGB), initially revealed by Rutledge, was proposed as a straightforward and successful treatment of morbid obesity. A few clear points of interest of the MGB contrasted and the best quality level LRYGB are single anastomosis, shorter expectation to absorb information, less inner imperfections for herniation and simplicity of modification or inversion. In the meantime, concerns identifying with the symptomatic biliary reflux and the danger of gastric/esophageal tumor have kept it across the board adoption. The aim of this study is to prospectively evaluate the glucose, HbA_1c, blood pressure and lipid profile before MGB and at 0, 3 & 6 months postoperatively.

Marco et al[5] study undertaken to prospectively evaluate the effect of different types of bariatric surgery on lipid profile in which Total cholesterol (TC), High-Density Lipoprotein cholesterol (HDLc), Low-Density-Lipoprotein cholesterol (LDLc) and Triglycerides (TG) levels were evaluated before surgery and at 3 different post-operative time-points (3, 6 and 12 months) in

consecutive obese subjects undergoing mini-gastric bypass (MGB) or sleeve gastrectomy (SG). During the post-operative follow-up, both MGB and SG subjects showed significant changes in lipid profile. However, at 3 months, MGB patients showed higher changes in TC (β=0.179, p=0.022) and TG (β=0.265, p=0.001) than those undergoing SG. At 6-month post-operative follow-up, these differences were confirmed only for TC. After a 12-month follow-up, MGB and SG were entirely comparable for changes in lipid profile with the exception of HDLc, whose changes were higher in SG group (β=0.130, p=0.039). Overall, the probability to normalize lipid profile during the 12-month follow-up was similar in MGB and in SG patients (OR:1.24, 95%CI:0.41-3.76, p=0.689). Despites some differences at 3-6 post-operative months, during a 12-month follow-up, SG and MGB showed a similar efficacy in the improvement of lipid profile of obese patients.

Halil et al[6] studied the efficacy of Laparoscopic Mini-Gastric Bypass for Type 2 Diabetes Mellitus in Obese Patients in the Bezmialem Preliminary Report and found significant reduction in the HbA1c levels from 9.8% to 6.2%.

An Italian study carried out by Musella et al[7] on 974 patients who underwent laparoscopic mini gastric bypass found it to be a short, simple, low-risk, effective, and durable bariatric procedure.

Yingjun et al[8] studied the efficacy of Laparoscopic mini gastric bypass for obesity and Type 2 Diabetes Mellitus found it to be effective in weight loss and T2DM remission.

Lee et al[9] evaluated the effect of laparoscopic mini gastric bypass for type 2 diabetes mellitus in patients with BMI < 35 kg/m^2 resulted in significant and sustained weight loss with successful treatment of T2DM upto 87.1%.

Patients with BMI <35 still had an acceptable DM resolution and this option can be offered to this group of patients.

Zisun et al[10] study done to evaluate the efficacy and safety of LMGB in non-obese T2DM patients (BMI 25-30 kg/m^2) demonstrated the resolution of hyperglycemia in 70 % of non-obese T2DM patients (BMI 25-30 kg/m^2).[10]

Asawer et al[4] study done for the effects of laparoscopic mini gastric bypass on weight loss and biomarker parameters in morbidly obese patients revealed significant reduction in FBG, HbA1c, cholesterol, TG, LDL and VLDL ($p<0.001$) and significant increase in HDL level ($p< 0.001$).

Rutledge[11] A study conducted to determine the rates and indications for inpatient hospital use before and after mini gastric bypass in comparison to similar rates in Roux-En-Y demonstrated hospitalisation following Mini Gastric Bypass Surgery decreased by 1/3rd, instead of rising, as reported with RNY. The study supported Mini Gastric Bypass as a low risk procedure that decreases the need for hospitalization.

6.3 AIMS AND OBJECTIVES OF THE STUDY

To evaluate the outcomes for Mini Gastric Bypass Surgery in terms of:

1. BMI
2. Diabetic Status
3. Hypertensive Status
4. Lipid Profile
5. Post-Operative Complications

7. MATERIALS AND METHODS

This prospective study will be conducted on obese subjects who will undergo Laparoscopic Mini Gastric Bypass Surgery for Morbid Obesity in Dayanand Medical College & Hospital, Ludhiana. Pre-operative evaluation will be done by a dedicated bariatric team which includes the bariatric surgeon, a dietician, an endocrinologist, a gastroenterologist, a psychiatrist, a chest physician, an anesthesiologist, and a cardiologist.

7.1 Source of Data

Patients coming to the Department of Surgery, Dayanand Medical College & Hospital, Ludhiana who have undergone or will undergo Laparoscopic Mini Gastric Bypass Surgery for Morbid Obesity. Prospective cases will include admissions from January, 2018 to December, 2018. Retrospective cases will include admissions from January, 2015 to December, 2017. Follow up will include 6 months from the date of surgery.

7.2 METHOD OF COLLECTION OF DATA

INCLUSION CRITERIA

- Morbid Obesity [BMI > 40 kg/m^2]
- BMI >37.5 kg/m^2 **AND** co-morbidities viz. Diabetes, Hypertension, Cardiovascular Disease, Hyperlipidemia.
- Failure with regimen of diet, physical activity and behavior therapy, for atleast 6 months.
- Patients highly motivated for bariatric surgery

EXCLUSION CRITERIA-

- Past history of any bariatric surgical intervention.

- Any hormonal reposition /block in the last 3 months
- Testicular impairment
- Phosphodiesterase type-5 inhibitor usage
- Patients suffering from terminal illness unlikely to be improved with weight reduction, including advanced stage cancer and end-stage renal, hepatic and cardiopulmonary disease.
- Patients who were unable to understand the nature of bariatric surgery or the behavioral changes required afterwards, including untreated schizophrenia, active substance abuse, and noncompliance with previous medical care.
- Patients not consenting to participate in the study
- Patients opting out of the study at any time during the study

METHODS OF COLLECTION

1. Inclusion and exclusion criteria will be applied to patients presenting to the Surgery Department of Dayanand Medical College & Hospital, Ludhiana only.
2. Patients fulfilling the inclusion and exclusion criteria will be taken into the study.
3. Patients will be educated about the study and only those patients consenting to participate in the study will be included. Written informed consent will be taken from every participant included in the study.
4. Database collection will include documentation of medical history, age, sex, pre hospital interval, vital signs, abdominal signs and drug history.
5. Routine investigations such as Hemogram, RFT, LFT, Chest X Ray, Ultrasound abdomen, CECT Abdomen will be done.

6. Patients with morbid obesity based on body mass index will be taken into the study.
7. Outcome of the patient will be evaluated uptill 6 months after the surgery.

DURATION OF STUDY/NUMBER OF CASES

The study will be conducted in one and a half year time period on obese subjects who will undergo or have undergone Laparoscopic Mini Gastric Bypass Surgery for Morbid Obesity. Patients will be followed up for 6 months from the date of surgery.

OUTCOME

The outcome of the study will be assessed from the following parameters:

1. BMI
2. Blood Pressure
3. Fasting Blood Glucose/HbA1c
4. Lipid Profile : Very Low-Density Lipoprotein (VLDL), Low-Density Lipoprotein (LDL), High-Density Lipoprotein (HDL), Serum Triglyceride Level
5. Post-operative complications to be recorded at each follow up visit uptill 6 months from the date of surgery.

STATISTICAL ANALYSIS

Data will be described in terms of range; mean ±standard deviation (± SD), median, frequencies (number of cases) and relative frequencies (percentages) as appropriate. Comparison of quantitative variables will be done using paired t-test for independent samples for parametric data . For comparing categorical data, Chi square ($\chi 2$) test will be performed and exact

test will be used when the expected frequency is less than 5. A probability value (*p* value) less than 0.05 will be considered statistically significant. All statistical calculations will be done using SPSS (Statistical Package for the Social Science) SPSS 21 version statistical program for Microsoft Windows.

7.3 DOES THE STUDY REQUIRE ANY INVESTIGATIONS OR INTERVENTIONS TO BE CONDUCTED ON PATIENTS OR OTHER HUMANS OR ANIMALS? IF SO, PLEASE DESCRIBE BRIEFLY.

Yes, patients included in the study will undergo haematological, biochemical, radiological investigations. For this, patients included in the study will be informed regarding their inclusion and written informed consent will be taken from all the patients included in the study. These are, however, essential for the patient management and are a part of the routine protocol for the management for patients undergoing laparoscopic mini gastric bypass surgery.

7.4 HAS ETHICAL CLEARANCE BEEN OBTAINED FROM YOUR INSTITUTION IN CASE OF 7.3?

Attached herewith

LIST OF REFERENCES

1. Chaturvedi A, Jane N. Obesity and Insulin Resistance: an overview. J Biol Sci Opinion. 2014:2(6):369-72.
2. Bleich S, Cutler D, Murray C, Adams A. why is the developed world obese? Annu Rev Public Health (Research Support). 2008;29:273-95.
3. Rogula T, Brethauer S, Chand B, Schauer P. Bariatric Surgery as a treatment for Type 2 Diabetes. Obesity Action Coalition.
4. Asawer Hasan Najm. Effects of Laparoscpoic Mini Gatsric Bypass (MGB) on Weight Loss and Biomarker Parameters in Morbidly Obese Patients: A 6-Month Follow-Up. Research Journal of Pharmacy and Technology. 2017;10:.
5. Marco Milone. Roberta Lupoli, Paola Maietta, Mario Musella. Lipid profile changes in patients undergoing bariatric surgery: A comparative study between sleeve gastrectomy and mini-gastric bypass. Article January 2015.
6. Coskun H, Bozkurt S, Memmi N, Cipe G, Ersoy YE, Karatepe O, et al. The Efficacy of Laparoscopic Mini-Gatsric Bypass for Type-2 Diabetes in Obese patients : the Bezmialem Preliminary Report. Society of American Gatsrointestinal and Endoscopic Surgeons.
7. Musella M, Susa A, Greco F, De Luca M, Manno E. The laparoscopic mini-gatsric bypass: the Italian experience: outcomes of 974 consecutive cases in a multicenter review. Surg. Endosc. 2014;28(1):156-63.
8. Yingjun Quan, Ao Huang, Min Ye, Ming Xu, Biao Zhuang. Efficacy of Laparoscopic mini gastric bypass for obesity and Type 2 Diabetes Mellitus:

A Systematic Review and Meta-Analysis. Gastroenterology Research and Practice Volume. 2015;2015:152852.

9. Lee Wj, Wang W, Lee YC, Huang MT, Ser KH, Chen JC. Effect of Laparoscopic Mini Gastric Bypass for Type 2 Diabetes Mellitus: Comparison of BMI > 35 and < 35 kg/m^2. J Gastrointest Surg. 2008;12(5):945-52.
10. Zisun Kim, Kyung Yul Hur. Laparoscopic Mini Gastric Bypass for Type 2 Diabetes: The Preliminary Report. World J Surg. 2011;35:631-6.
11. Robert Rutledge. Hospitalisation Before And After Mini Gastric Bypass Surgery. Center For Excellence In Laparoscopic Obesity Surgery. Int J Surg. 2007;5(1):35-40.
12. Lomanto D, Lee WJ, Goel R, Lee JJ, Shabbir A, So JB, et al. Bariatric Surgery in Asia in the Last 5 Years (2005–2009)", Obesity Surgery. 2011;22(3):502–6.
13. Marmuse JP, Parenti LR. Gastric bypass. Principles, complications, and results. Journal of Visceral Surgery. 2010;147:31–7.
14. Wei-Jei L, Po-Jui Y, Weu W., Tai-Chi C, Po-Li W, Ming-Te H. Laparoscopic Roux-en-Y Versus Mini-Gastric Bypass for the Treatment of Morbid Obesity A Prospective Randomized Controlled Clinical Trial. Ann Surg. 2005;242:20–8
15. Johnson WH, Fernanadez AZ, Farrell TM. Surgical revision of loop ('mini') gastric bypass procedure: multicenter review of complications and conversions to Roux-en-Y gastric bypass. Surg Obes Relat Dis. 2007;3:37–41.

16. Abdolreza P.; Sima Karbalaei E. Excessive Weight Loss Following Laparoscopic Gastric Mini Bypass or Roux-En-Y Gastric Bypass Surgery. International Journal of Clinical Medicine. 2016;7:445-9.

17. NIH conference. Gastrointestinal surgery for severe obesity. Consensus Development Conference Panel. Ann Intern Med. 1991;115:956-61.

18. Pories WJ, Swanson MS, MacDonald KG, Long SB, Morris PG. Brown B.M.et al. Who would have thought it? An operation proves to be the most effective therapy for adult-onset diabetes mellitus. Ann Surg, 1995;222:339-50.

19. O'Brien PE, Dixon JB, Laurie C, Skinner S, Proietto J, McNeil J. et al. Treatment of mild to moderate obesity with laparoscopic adjustable gastric banding or an intensive medical program: a randomized trial. Ann Intern Med. 2006;144:625-33.

PROFORMA

Sr. No_____

Name

Age/Sex

CR. No

Address

Occupation

Mobile

Chief Complaints

History of Present Illness

Vitals (On Admission)

General Physical Examination

Provisional Diagnosis

PARAMETERS –

	Before Surgery	Post Op Day 1	3 Months Post Op	6 Months Post Op
BMI				
FBS/HbA1c				
BP				
Lipid Profile				

*BMI = [Weight(kg)/Height(m)^2]

*Lipid Profile includes HDL, LDL, VLDL, Triglyceride levels in blood

Treatment

Post Op Complications (If Any)

Signature of Candidate

Signature of Supervisor

INFORMED PATIENT CONSENT

Date: _____

I.....D/o, W/o, S/o.....

.....am willing to participate in the study **"EVALUATION OF OUTCOME FOLLOWING MINI GASTRIC BYPASS SURGERY FOR MORBID OBESITY"** The procedure with its complications has been explained to me in local vernacular language. I have fully understood that no special tests and extra expenditure in any form, merely for the purpose of thesis is being carried out. I am free to opt out the study any time without assigning any reason.

.....
Signature of the Witness

Name:

.....
Signature of the patient

Signature of Candidate

Signature of Supervisor

मरीज अनुमति फार्म

तिथि _____

मैं _____ पत्नी/पुत्र/पुत्री _____

निवासी _____

इस शोधकार्य **"EVALUATION OF OUTCOME FOLLOWING MINI GASTRIC BYPASS SURGERY FOR MORBID OBESITY"** में भाग लेने के लिए सहमत हूँ। मैं इस शोधकार्य में भाग लेने के लिए अपनी स्वेच्छा से तैयार हूँ। मैं पुष्टि करता/करती हूँ की यह स्वीकृति देने के लिए मुझे कोई आर्थिक प्रलोभन नहीं दिया गया और न ही दबाव डाला गया है। मुझे इस शोधकार्य का उद्देश्य स्पष्ट कर दिया गया है और मुझे यह विश्वास है की यह विज्ञान और मानवता के लाभ के लिए है। मुझे इस शोधकार्य में होने वाले जोखिम के बारे में समझा दिया गया है और मेरी समझ में यह जोखिम बहुत मामुली है।

मैं इस शोधकार्य में भाग लेने के सम्बन्ध में किसी भी समय अपनी अस्वीकृति व्यक्त कर सकता/सकती हूँ और मेरे अस्वीकृति व्यक्त करने का मेरे इलाज पर कोई प्रभाव नहीं पड़ेगा।

_____

गवाह के हस्ताक्षर

नाम:

_____

रोगी के हस्ताक्षर/अंगूठे का निशान

नाम:

_____

अन्वेषक के हस्ताक्षर

_____

विद्यार्थी के हस्ताक्षर

ਮਰੀਜ਼ ਰਜ਼ਾਮੰਦੀ ਫਾਰਮ

ਮਿਤੀ_____

ਮੈ_____ਪਤਨੀ/ਪੁੱਤਰ/ਪੁੱਤਰੀ_____

ਵਾਸੀ _____

"EVALUATION OF OUTCOME FOLLOWING MINI GASTRIC BYPASS SURGERY FOR MORBID OBESITY" ਤੇ ਚਲ ਰਹੀ ਖੋਜ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਲਈ ਰਜ਼ਾਮੰਦ ਹਾਂ। ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਲਈ ਮੈ ਆਪਣੀ ਮਰਜ਼ੀ ਨਾਲ ਤਿਆਰ ਹਾਂ। ਮੈ ਇਹ ਦਸਣਾ ਚਾਹੁੰਦਾ ਹਾਂ/ ਚਾਹੁੰਦੀ ਹਾਂ ਕੇ ਇਹ ਰਜ਼ਾਮੰਦੀ ਦੇਣ ਵਾਸਤੇ ਮੈਨੂ ਕਿਸੇ ਵੀ ਤਰਾਂ ਦਾ ਲੋਭ-ਲਾਲਚ ਨਹੀ ਦਿੱਤਾ ਗਿਆ ਅਤੇ ਨਾ ਹੀ ਕੋਈ ਦਬਾ ਪਾਇਆ ਗਿਆ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਦਾ ਮਨੋਰਥ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ ਅਤੇ ਮੈਨੂ ਇਹ ਭਰੋਸਾ ਦਵਾਇਆ ਗਿਆ ਹੈ ਕੇ ਇਹ ਖੋਜ ਵਿਗਿਆਨ ਅਤੇ ਮਾਨਵਤਾ ਦੀ ਭਲਾਈ ਲਈ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਵਿਚ ਹੋਣ ਵਾਲੇ ਖਤਰੇ ਬਾਰੇ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ ਅਤੇ ਮੈਨੂ ਇਹ ਯਕੀਨ ਹੈ ਕੇ ਇਹ ਖਤਰਾ ਬਹੁਤ ਮਾਮੂਲੀ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਦਾ ਢੰਗ – ਤਰੀਕਾ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ।
ਮੈ ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਬਾਰੇ ਆਪਣੀ ਰਜ਼ਾਮੰਦੀ ਕਿਸੇ ਵੀ ਸਮੇ ਵਾਪਸ ਲੈ ਸਕਦਾ ਹਾਂ/ ਸਕਦੀ ਹਾਂ ਅਤੇ ਮੇਰੀ ਰਜ਼ਾਮੰਦੀ ਵਾਪਸ ਲੈਣ ਦਾ ਮੇਰੇ ਇਲਾਜ ਤੇ ਕੋਈ ਅਸਰ ਨਹੀ ਹੋਵੇਗਾ।

_____ _____

ਗਵਾਹ ਦੇ ਹਸਤਾਖਰ ਮਰੀਜ਼ ਦੇ ਹਸਤਾਖਰ

ਮਿਤੀ_____ ਮਿਤੀ_____

ਪਤਾ _____ ਪਤਾ _____

_____

ਨਿਰੀਖਕ ਦੇ ਹਸਤਾਖਰ

_____

ਸਿਖਿਆਰਥੀ ਦੇ ਹਸਤਾਖਰ